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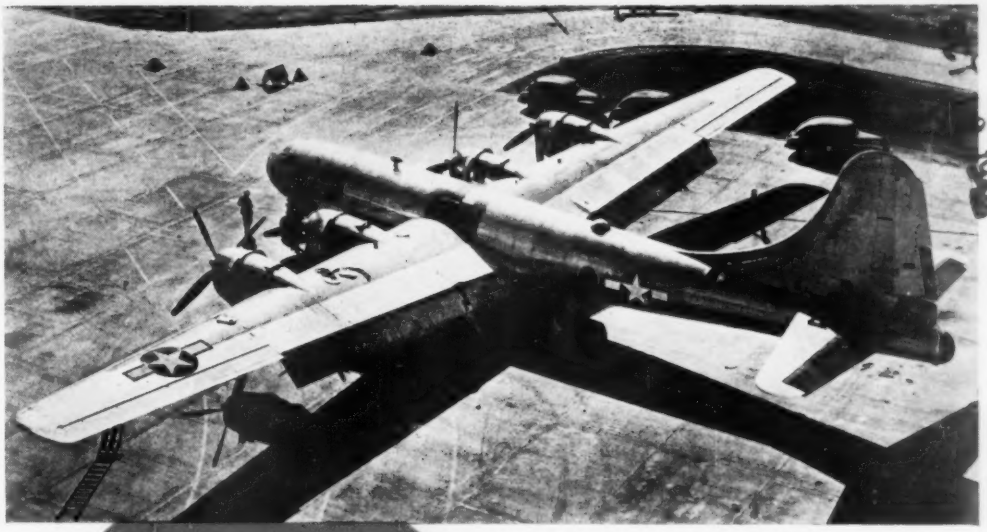

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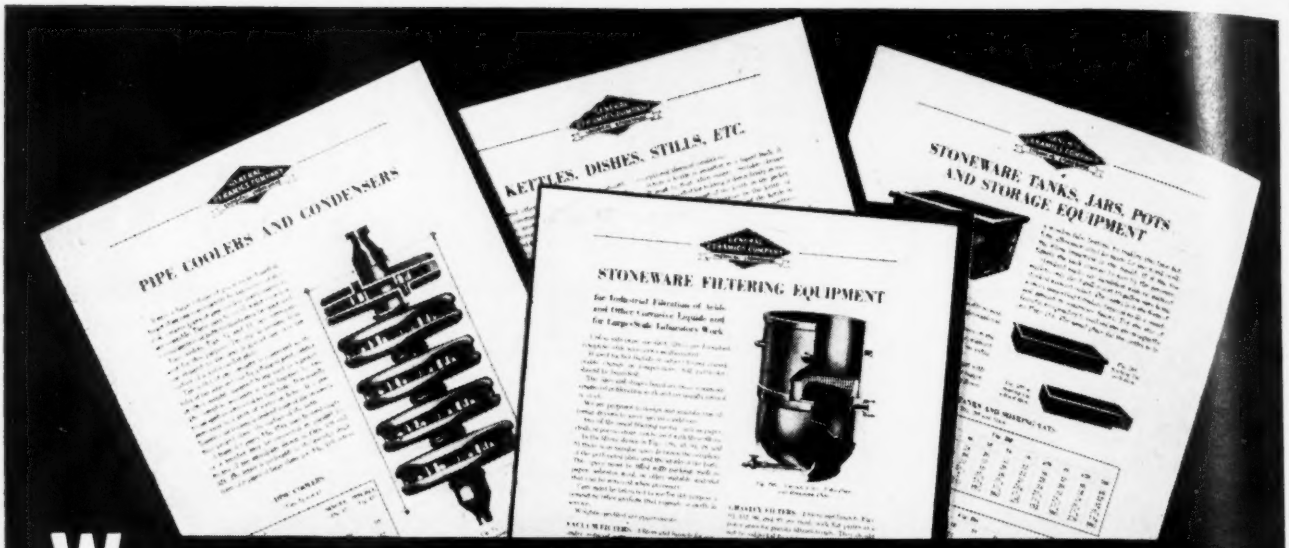

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VOL. 42, NO. 10 METAL FINISHING OCTOBER, 1944
PREPARATION, ELECTROPLATING, COATING

METRIC MERIT

Ask platers which is heavier—an ounce of salt or an ounce of gold, and in most cases the correct answer will be given, namely the latter, which is expressed in troy weight and is, therefore, about ten per cent heavier. Ask them the value of the silver in an ounce of silver cyanide, however, and only a few will give the correct answer since most platers are not aware that, although silver is sold by the troy ounce, silver cyanide is sold by the avoirdupois ounce.

Occasionally we have been troubled by references to quarts which do not state whether dry or liquid measure, and for years we have been making mental corrections, when reading formulas in British and Canadian publications, for the difference between the U. S. gallon and the Imperial or British gallon. Our discovery, however, that even the British and American inches differ makes us wonder why we continue to use a system of measurement which is not only out of step with the rest of the world but even requires interpretation and clarification.

In the English system a quart may be U. S. dry, U. S. liquid or British liquid—all different; an ounce may be U. S. fluid, British fluid, avoirdupois or troy—all different; a bushel may be any of fifty-six kinds; but, in the metric system a liter is a liter and a gram is a gram—there is no question about it.

In the field of science the superiority of the metric system has long been acknowledged but progress towards its adoption in this country has been painfully slow. Wherever figures in the English system are given in the Transactions of The Electrochemical Society, they are accompanied by the metric equivalents. The Committee on National Formulary of the American Pharmaceutical Association has recently decided to give metric doses greater emphasis in the new National Formulary, and the Council on Pharmacy and Chemistry of the American Medical Association has taken a great step forward in deciding to use only the metric system in publications for which it is responsible.

Our men overseas are learning a great deal about the advantages of the metric system and their experiences will undoubtedly hasten its general adoption in this country after the war. The plating industry stands to benefit greatly by adoption of this system.

The Principal Health Hazards in Metal Finishing Departments and Their Control*

By MERRIL EISENBUD

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THE Finishing Department foreman may be, in a general way, aware of the potential danger involved in certain of his operations, but frequently postpones calling the attention of management to the need for protective measures because he does not have a clear understanding of the problem and is unable to evaluate the potential exposure to determine if it is dangerous.

This paper will discuss the hazards which are encountered from the use of certain materials commonly used in the metal finishing industries. The industrial hygiene hazards from electroplating have been discussed before, but the need for considerable further education on this subject is indicated by the cases of health damage which continue to be reported from the field. These cases vary in severity from reports of minor skin irritation from contact with chemicals used to some which result in death from inhalation of fumes, mists, and vapors given off in the processes. Most trouble does not arise out of unusual or accidental conditions, but is the result of poor operating practices which have existed for an extended period of time.

In a plating department there are numerous operations which cause uncomfortable atmospheric contamination, but some that are more obnoxious are the least harmful to the health. Conversely, some operations which are much less obnoxious can produce contamination of a subtle, insidious nature which will produce serious health damage. The innocent looking pan of carbon tetrachloride used to degrease small parts, preparatory to plating, can result in health impairment, even death, whereas the hot alkali wash which throws off steaming vapors which are irritating to the eyes, and is a nuisance to every one who has to work near it, does not produce systematic poisoning. Certainly, economical methods of ventilation are available for the disposal of vapors from baths of this kind and such control methods should be installed in the interest of better working conditions and the ultimate improvement in the overall operation of the department which results, but this comparison is made to show how important it is that knowledge concerning the physiological effects of gases, mists, vapors, fumes, and dusts from metal finishing processes be made available to the industry, so that management can differentiate between the "nuisance" hazards and those that are of more significance.

In many plants the protective measures are taken in conjunction with a program of air analysis in order to determine the extent of contamination and degree of control which results from whatever protective installations are made. Air analysis is useful in the finishing department, but fortunately, enough data are available on the major potential hazards to enable management to decide where control is necessary and what type should be applied.

The hazards which will be emphasized in this paper can be considered the ones which of all potential hazards existing in a finishing department are most likely to cause trouble. Of major importance are solvent degreasing, nitric acid (bright) dip, the use of chromic acid in plating and anodizing, and dermatitis from contact with caustic or irritating chemicals. Adequate control over the dusts, vapors, and mists which arise out of these operations will eliminate most of the health damage which occurs. Other hazards which require attention and which must be investigated are those from cyanide mists from cyanide plating operations, vapors from the many alkali cleaning and finishing baths, mists from phospheric, sulfuric, and hydrochloric acid pickling vats, and dust from blast cleaning.

Alkali Cleaning and Finishing

The vapors and mists from alkaline solutions used for cleaning and finishing are frequently obnoxious and their "nuisance" value more than justifies the installation of a ventilating system. This type of atmospheric contamination is apparently not injurious to the system, but it is often present in sufficient concentrations to cause irritation to the eyes and upper respiratory tract. Irritations of this type have been reported from many plants and have resulted in the installation of local exhaust systems to remove the vapors. No general rule can be stated which would make it possible to draw the line between those alkaline baths which should be ventilated and those which need not be.

Pickling Vats

Questions sometimes arise on the effect of vapors from phosphoric, sulfuric, and hydrochloric acid pickling. The problem presented by these materials is somewhat the same as for the alkalis discussed above. If pickling solutions of sufficient strength are operated at a high enough temperature, considerable fume or mist will be evolved, and will be irritating to employees. In addition to the irritation on the eyes and upper respiratory tract, it is said that abnormal dental decay exists among employees exposed to the vapors of these acids because of the direct action of the acid on the teeth. If there is evidence of excessive contamination from these tanks, local lateral exhausts of the type discussed for chromium plating should be installed.

Nitrous Fumes

Fatalities from breathing the nitrous fumes from nitric acid bright dip solutions are by no means rare. Under some operating conditions the brown oxides of nitrogen may be given off in sufficient strength to cause death from the delayed pulmonary irritation which results from a single breath of the fume. One such case was recently reported from an electroplating shop where a 50-50 nitric-sulfuric acid bright

* *Presented at the Fifteenth Annual Convention of the Greater New York Safety Council.*

dip was employed in a crock out of doors. The foreman was aware of the danger of nitrous fumes, and because he only had a few days' need for the dip he decided to place it out-of-doors where he thought the natural ventilation would protect the operator. The employee died from what appeared to be the classical symptoms of nitrous fume poisoning several hours after leaving work on the first day.

This hazard may exist when crocks or carboys of the acid are broken. Fatalities have resulted where men have attempted to flush down spilled nitric acid, and there is ample evidence to support the recommendation that all employees should leave the scene of such a breakage until the acid has been thoroughly flushed by employees provided with gas masks approved for the acid gases.

Crocks of nitric acid mixtures should be kept in a water-filled dike as a precaution against breakage. Carboys should be handled carefully with the aid of a practical carboy jig. The crock of acid used for bright dipping should be provided with a lateral exhaust to dispose of the nitrous fumes given off by the operation.

Chromic Acid

The hazards from the use of chromic acid in chromium plating have long been recognized and the precautions which must be taken have been reported by various authors. The more recent use of chromic acid as an electrolyte in anodizing calls for approximately the same type of control over the hazard.

The maximum permissible concentration for prolonged exposure to chromic acid is 0.1 milligrams per cubic meter of air. Contamination in excess of this figure is known to produce ulcerations in the upper respiratory passage and local ventilation is necessary in order to keep the concentration within allowable limits. The principal source of contamination has been considered the mists which arise from the electrolytic bath as a result of the high current densities and the rapid liberation of hydrogen and oxygen, but it has been found that nasal ulceration is sometimes present among employees working near chromium plating and anodizing tanks despite the fact that adequate ventilation has been provided. These cases have been traced to bad practices during the dumping of chromic acid flakes into the tank. Although this operation may not take place more than once or twice a week, the total chromic acid dust breathed in the short time it takes to dump the flakes is sufficient to injure the nasal passage. An approved dust respirator should be used by employees performing this operation.

The quantity of air which should be exhausted from these tanks in order to maintain safe atmospheric conditions in the immediate vicinity of the operation can be calculated by allowing 120 CFM per square foot of tank area. Of equal importance is the need for distributing the air flow evenly over the length of the tank. The reader is referred to "New Data for Practical Design of Ventilation for Electroplating" by Battista, Hatch, and Greenburg, in Heating, Piping and Air Conditioning, February, 1941, for details as to the proportioning and baffling of the manifolds on electroplating tank exhausts.

Cyanide Plating

The normal operating conditions in plating with electrolytes containing cyanide salts do not seem to result in hazardous atmospheric contamination.

The accidental introduction of an acid into the cyanide solution will, of course, result in the liberation of hydrocyanic gas. The consequences of such an accident are apt to be so serious that it is wise to provide proper ventilation of all cyanide plating operations just to take care of such an emergency. Ventilation of cyanide plating baths is advisable, but not mandatory. As an added precaution, no employees other than the foreman or whomever he may designate for the job, should be permitted to prepare the electrolyte or add anything once the bath has been prepared.

Occasionally one finds acid carboys and cyanides stored in the same room. This is a very dangerous practice which should not be permitted. The cyanides should be stored separately and kept under lock and key.

Abrasive Blasting

In finishing departments, abrasive blasting is usually performed within small cabinets which are either homemade or obtained commercially. The type of material being used as the abrasive is all important in evaluating the hazards. The occupational disease commonly associated with sand blasting is silicosis, and this lung disease can develop where an abrasive having a high quartz content is used without adequate control over the dust. On the other hand, recent years have seen the introduction of such materials as steel shot and aluminum oxide abrasive. Carborundum (silicon carbide) may also be used as an abrasive for this purpose. These materials do not contain silica (silicon dioxide) and their action on the lungs is altogether different from what is produced by silica sand. The maximum permissible concentration for exposure to silica dust is 5 million particles per cubic foot. That is, a person working 8 hours daily in a concentration below this figure would not be expected to develop silicosis. The dust from aluminum oxide, Carborundum, or steel cannot cause silicosis, although it is said that in high enough concentrations such dust may produce lung damage. Pneumoconiosis is a name given to the various lung diseases produced by dusts. The lung diseases produced by dusts found in the finishing department other than silica, are not severe, and there is no agreement as to what the maximum permissible concentrations of these non-silica dusts should be, but it can be said that authoritative references will vary from 15 to 100 million particles per cubic foot of air.

Modern blasting units are well designed, enclosed and ventilated. When new, there is very little dust dispersed to the outside atmosphere and no significant exposure should result from their use. However, it has been observed that over a period of years the effectiveness of these units deteriorate and considerable dust dispersal is evident unless accompanied by an adequate maintenance program. Lack of adequate maintenance can very easily result in exposing the employee to concentrations considerably in excess of the toxic limit where silica is involved. This could happen without attracting the attention of persons in the department because 5 million particles per cubic foot is not a lot of dust and certainly is well below the concentration which would manifest itself as a visibly dusty condition. Thus, by a breakdown in the exhaust of a blast cleaning unit it is possible for a silicosis exposure to develop without manifesting itself in any way except by the damage it will produce over a period of years on the employees involved. The use of sand should be

discontinued in favor of non-silica abrasives. The trend in this direction has been very definite during the past few years, but there are still a few places where sand is used and, as would be expected, this is often in old-fashioned equipment which does not provide adequate protection against the dust from this operation.

Buffing

Buffing operations are frequently a function of the finishing department. The health hazards encountered are not serious, but certain precautions should be observed. The dust from buffing operations can be considered as having about the same effect as the non-silica dusts mentioned above under "Abrasive Blasting." Natural pumice, and the rouges used do not contain silica although tripoli does, in appreciable amounts. Some years ago, a pumice substitute which had a high silica content appeared on the market and presented a definite silicosis threat. Some caution must be observed whenever a new polishing compound is introduced and an effort should be made to determine its free silica content.

The American Standards Association have issued Standard 243—1941 which covers Grinding, Polishing, and Buffing Equipment Sanitation. The interested reader is referred to that source for information on the design of buffing wheel exhausts. Needless to say, buffing wheels should be exhausted in order to control the dust. The A.S.A. specify the hood shape most suitable for buffing wheel exhausts and also recommend the volume of air which should be exhausted for the different wheel diameters.

Dermatitis

Skin lesions are frequently reported from finishing departments and there are certain definite precautionary measures which should be taken to minimize the frequency and severity of these cases. Virtually all of the salts, acids, and alkalis, which are used in plating operations are irritating to the skin and can cause burns, ulcers, or rashes, depending on the characteristics of the material involved, frequency of contact, and the susceptibility of the employee to skin pathology.

Much could be said about this subject, but for purposes of this discussion we will summarize it briefly by stating that the dermatitis can be minimized if contact with the materials is avoided. This is a very obvious statement to make, but it can be said that most of the skin troubles in electroplating departments exist because of carelessness on the part of experienced workers who do not take advantage of the protective clothing that is available to them and who, by their own careless working habits, needlessly expose themselves to the irritating action which many of these materials have on the skin. In one department which the writer visited, it was found that all of the employees working at a silver plating operation had numerous ulcers on their arms and legs. These ulcers came from the action of the cyanide salt on the skin and disappeared when the employees were instructed to avoid immersing their hands and arms in the electrolyte, to stop splashing the electrolyte about needlessly, to wear gloves, and to launder their work clothes occasionally to prevent these clothes from becoming saturated with the cyanide solution. Similar experiences have been recorded with regard to the chromates and other materials commonly used in a plating department.

The common sense suggestions followed in the above case would eliminate most of the dermatitis reported from electroplating departments. In some instances the physician will find that an individual is so sensitive to one or more of the materials used that it is necessary for him to be assigned to a job which will completely eliminate his contact with the material to which he is allergic. These cases are unusual, but do occur from time to time.

Degreasing

Trichlorethylene is the most commonly used of the various solvents employed in degreasers and it is the basic ingredient of solvents sold under various trade names. The various commercial brands of trichlorethylene vary somewhat as to the type of inhibitors and stabilizers used to prevent the solvent from breaking down with a liberation of hydrochloric acid. This breakdown is in itself probably of no hygienic significance although enough hydrochloric acid to manifest itself as a mild atmospheric irritant is sometimes observed in the vicinity of badly operated degreasers.

The hazard from the degreasing operation which concerns us most is that of inhalation of the solvent vapors. This can be divided into two types of exposure: first, the prolonged inhalation of low concentrations of vapor during regular operation of the unit; and, second, the breathing of relatively high concentrations for a short period of time, as would be true if an employee were required to enter a degreasing unit for cleaning or repairs. The two problems presented are different as to the effects produced on the body and in the precautions which must be taken to safeguard the health of personnel involved.

Exposure to high concentrations produces acute symptoms which are fairly well understood because trichlorethylene has been used in medicine as an anesthetic, but the effects of prolonged exposure to subacute concentrations of this vapor are not entirely clear. The medical literature on the chronic toxicity of trichlorethylene is controversial with respect to the organs, or combinations of organs of the body that are affected by prolonged exposure to various concentrations of the solvent, but this is not the place to discuss this aspect of the subject. Most authorities specify 200 parts per million parts of air as the maximum safe concentration for continued exposure to the vapors of this solvent.

If the manufacturers' operating instructions are followed, employees working at or near a well designed degreaser will not be exposed to concentrations in excess of 200 parts per million. A well designed degreaser is one which is preferably electrically or steam heated and is provided with the necessary equipment for maintaining a thermal balance between the heat input and output. The temperature of the outlet water may be controlled automatically or manually, but should not be permitted to exceed 110° F., which is the usual upper limit recommended. If the rate of flow is not controlled thermostatically, a thermometer should be provided in the line and the operator instructed to keep the temperature within the prescribed range. The temperature of the inlet water is also important, and a thermometer should be provided at that point in order that the operator can keep the inlet water above the recommended temperature of 70° F. If this water is at a temperature below the dew point of the air, condensation on the cooling jacket will result, and water will contaminate the solvent, hastening its decomposi-

tion and the liberation of corrosive hydrochloric acid.

The freeboard distance, the space between the top of the cooling coils and the top of the tank, should not be less than 18 inches. This is an important feature which is taken into consideration in the design of all modern degreasers, but some of the early models have inadequate freeboard and thus facilitate spillage of the solvent vapors over the tank edge.

Air currents which disturb the vapor are one cause for excessive contamination. It is important that the degreaser be located away from open windows, fans, supply grills, etc. Baffles can be provided where it is necessary to reduce air movement.

Parts to be degreased should be placed into the basket in such a manner that concave surfaces will face downward. This will assist the degreasing action and at the same time eliminate the accumulations of residual solvent when the basket is removed.

The manufacturers recommend that work be placed into and withdrawn from the degreaser at a speed not greater than 12 feet per minute. Haste is responsible for much of the vapor contamination found in the breathing zone around degreasers. If a mechanical hoist is provided, the speed can be adjusted so that this problem need not exist. But many of the smaller degreasers have no such equipment and the operator is apt to shove his basket into the tank in such a manner as to cause a rapid displacement of the vapors, with the result that there will be considerable loss from the tank. Likewise, too rapid withdrawal will cause entrainment of vapors and solvent. If parts are not thoroughly dry of solvent before removal from the tank, the evaporation takes place in the open room, and the exposure to employees is that much greater.

If a degreaser is well designed, well operated, and located in a large, well ventilated room, it should not be necessary to provide local exhaust ventilation for the unit. All data on the subject seems to agree on this point although some authorities suggest the use of slot type lateral ventilation in order to safeguard against careless operating practices. The recommended ventilation rate is 50 cubic feet per minute per square foot of tank area.

Cleaning or repairing degreasers may involve the entry of employees into the tank, and measures must be taken to protect them against the high concentrations to which they may be exposed. In high concentrations such as are apt to be encountered, the vapors act as a depressant on the central nervous system and can produce unconsciousness or death in a short while. In large degreasers, it is possible that so much vapor is present, that an oxygen deficiency may exist, thus adding the hazard of asphyxiation to that from the vapor toxicity. The manufacturer of the degreaser should be consulted for the precautions which should be followed prior to and during entry of the tank. Briefly, these precautions should consist of allowing the solvent to cool, opening all manholes and doors, and providing the employees with a hose type respirator. Chemical cartridge type respirators or gas masks will not safeguard the employee if an oxygen deficiency exists; hence, the need for an air line or hose type respirator.

The information contained in this paper is summarized in the accompanying table. The writer is indebted to the American Standards Association, who originally classified the electroplating systems according to their degree of hazard. The only departure from their original classification is anodizing which has been moved from MODERATE HAZARD to CONSIDERABLE HAZARD, because our recent experience has shown this to be warranted.

Summary of Electroplating Hazards and Their Control

Operation	*Method of Control*	*Maximum Allowable Concentration in Air*
CONSIDERABLE HAZARD		
Chromium Plating Arsenic Plating Anodizing (chromic acid)	Lateral exhaust at rate of 120 CFM per square foot of solution surface.	0.1 mg. Cr per cu. m. 0.15 mg. As per cu. m.
Solvent Degreasing:		
A. Using chlorinated solvents in open vessels.	Ventilation of vapors by means of an exhausted partial enclosure of both dipping and drying chambers.	200 p.p.m. trichlorethylene 100 p.p.m. carbon tetrachloride 200 p.p.m. perchlorethylene
B. Use of commercial degreasing unit.	Close adherence to manufacturers' instructions for operation of the unit.	
Buffing	1. Use of non-silica polishing materials. 2. Use of approved ventilation for all buffing wheels.	
Bright Dip (nitric-sulphuric acids)	Local exhaust ventilation to remove brown oxide of nitrogen.	25 p.p.m. of nitrogen oxides
	* * * * *	
MODERATE HAZARD		
Cyanide solutions for plating copper, brass, bronze, zinc, cadmium.	Lateral exhaust of tanks is desirable, but not mandatory.	20 p.p.m. for hydrogen cyanide 0.1 mg. Cd per cu. m.
Blast Cleaning	1. Use of non-silica abrasive. 2. Maintenance of a well constructed exhausted blast cabinet. 3. Use of approved respiratory protection where blast rooms are used.	5 million particles of free silica per cubic foot. "Thresholds" for other abrasive dusts are not established
	* * * * *	
SLIGHT HAZARD		
Acid or neutral solutions for plating copper, zinc, nickel, lead.	Exhaust not necessary for normal plating procedures.	0.15 mg. Pb per cu. m.
Pickling, Alkali Baths (hydrochloric, phosphoric and sulphuric acids)	No precautions necessary under normal operating conditions. Ventilation is desirable at elevated temperatures.	10 p.p.m. hydrochloric acid

THICKNESS MEASUREMENTS of ELECTRODEPOSITED METALS*

By RICHARD B. SALTONSTALL

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PROBABLY no single factor has harmed the electroplating industry as much as coatings of poor quality. This has been the combined faults of both the plater and his customer. Quotations have often been requested on equipment for plating a certain number of parts in a given time, with no mention made as to the thickness of deposit required. Many times we have heard the term "just a good commercial job" in answer to the question "What thickness is required?" Fortunately, during the past few years, this situation has been improving rapidly and the impetus given to this improvement by the war has been great. We are learning to think of thickness of deposit as a measure of quality. Therefore, in order to furnish the required protection, it is vital not only to measure thickness of deposit, but to control plating operations in such a way that thickness requirements are met.

This logically leads to a brief discussion of the thickness specification itself. Quality plating specifications should call for certain minimum thicknesses on significant surfaces for various types of exposure. However, practical limitations of electroplating processes should be considered when writing such specifications. An excellent example of this is AN-QQ-P-421a with Amendment 1 for cadmium plating. A minimum thickness of 0.0003" is specified, and then qualified as follows:

"Except on

(a) Articles having integral parts which are threaded externally

(b) Parts whose dimensional tolerances will not permit a coating of 0.0003"

(c) Holes, recesses, and other areas where a controlled deposit cannot be obtained under normal plating conditions."

A lower minimum thickness (0.0002") is specified for (a) and (b) and no requirements are established for (c). The specification then states that with the exceptions noted above, the thickness of plating shall be considered only where the surface of the article can be touched by a sphere 0.75" in diameter.

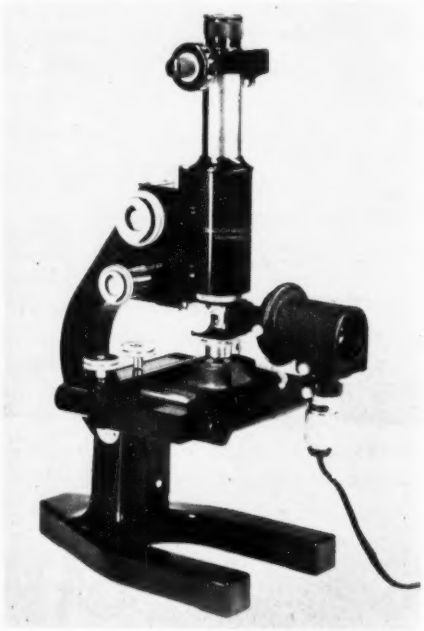


Fig. 1. The metallurgical microscope.

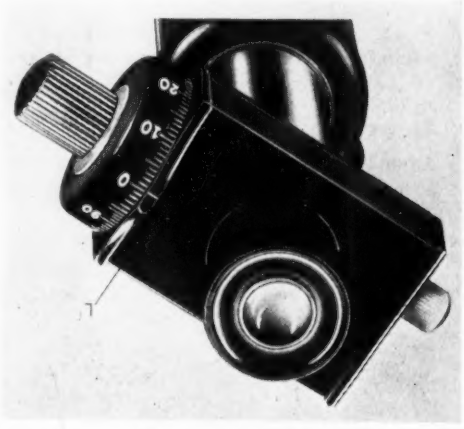


Fig. 2. Filar ocular.

Naturally, for parts having areas included in these exceptions which, because of their specific use, must be heavily plated, specific instructions will have to be issued. This procedure, however, is much better than writing a specification which is extremely rigid and difficult to meet and having to make exceptions and allowances for most of the parts plated.

The next question which we will discuss is, what method shall be chosen for measuring thickness? The general requirements for an ideal method, according to Wallbank, would be

1. high accuracy
2. speed of operation
3. simplicity
4. moderate cost of equipment
5. no damage either to the coating or the basis metal
6. applicability to all types of coatings and basis metals.

Since no single method is known which meets all of these requirements, we shall describe briefly the methods most used, discuss the relative merits of each, and to which metals it is applicable.

Methods for measuring thickness of electrodeposited coatings have been divided into five general classifications, depending on the units in which the determination is actually made. These are:

1. Direct Measurements
2. Timing Processes
3. Weighing Operations
4. Magnetic Measurements
5. Electrolytic Tests.

Direct Measurements

(a) Microscopic (Metallographic) Method

The metallurgical microscope (Fig. 1) is one of the basic standards for thickness measurement. When used for this purpose, it is equipped with a filar ocular or eyepiece (Fig. 2) which has been carefully calibrated against a stage micrometer. A small specimen is cut from the plated article at the point where the thickness is to be measured. The specimen is mounted

* *Presented before the Metal Finishing Society of Rockford, Ill., March, 1944.*

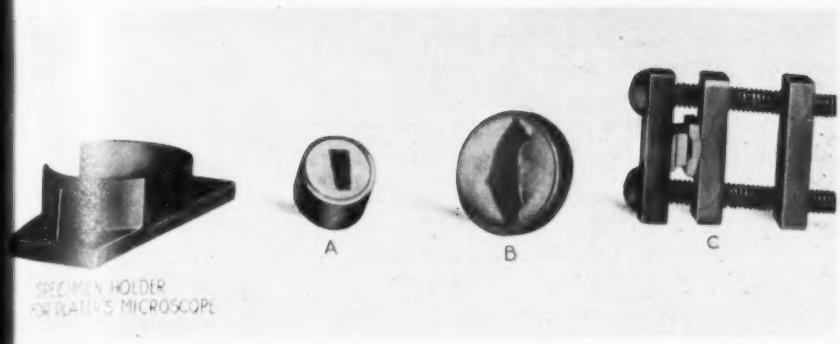
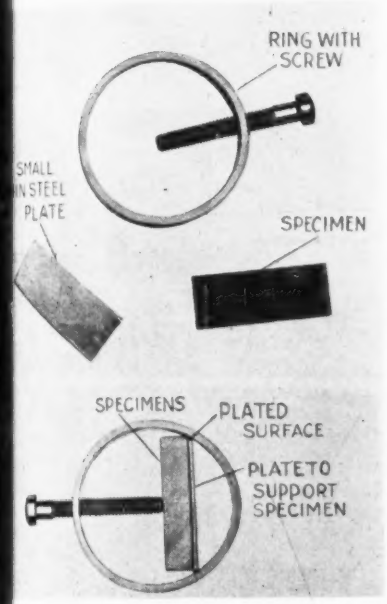


Fig. 3. Methods for mounting specimens for metallographic examination.
(a) Mounting in low melting alloy.
(b) Mounting in plastic.
(c) Mounting in steel clamp.



ig. 4. Ring method for mounting metallographic specimens.

n a clamp or cast in low melting lloy or synthetic resin (Figs. 3 & 4), olished by regular metallographic ethods in a plane perpendicular to he deposit so that a cross section of he plated surface is shown, etched if ecessary, and the thickness measured ith the microscope.

This method is of special value in easuring the thickness of composite oatings of a hard and a soft metal uch as nickel and copper. When the oft metals alone are measured by this ethod there is a tendency for draging or distortion, and special precauions must be taken. The article is of ourse destroyed. The smallest thickess which can be accurately measured y this method using the equipment as llustrated is about 0.0001".

(b) Chord Method

The chord method, developed by Mesle, is an interesting form of direct measurement. Coatings on flat surfaces are cut through by a circular precision grinding wheel of known radius "R" (Fig. 5). The width of the cut, the chord "C" is accurately measured with a magnifier and the thickness "T" calculated from the formula. Curved surfaces of known radius can also be measured by this method (Fig. 6). A flat grinding surface is applied to the curved surface until the plate is just cut through. The formula shown is used, "R" being the radius of the plated surface. This method is applicable to any combination of plate and basis metal which show sufficient contrast. It is accurate within 10% on coatings 0.0002" thick or over. Unfortunately this method is not practical for use on concave surfaces where minimum thicknesses are usually found.

(c) Micrometer Method

Measurement by micrometer caliper is not useful for deposits less than 0.001" thick. Its principal application is in measuring heavy deposits of chromium, nickel, silver, etc., for engineering applications. Because of its nature, the method is seldom applicable to measurement of minimum thicknesses, which are usually found in recesses of irregularly shaped articles. Roughness of deposit or basis metal can cause serious errors.

Time Methods

These methods are all dependent on accurate measurement by a stop-watch,

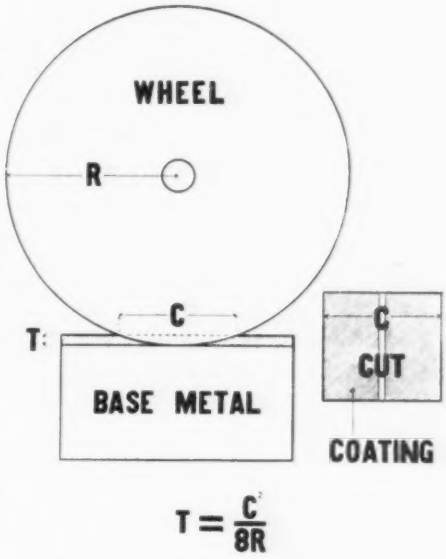


Fig. 5. The chord method for plane surfaces.

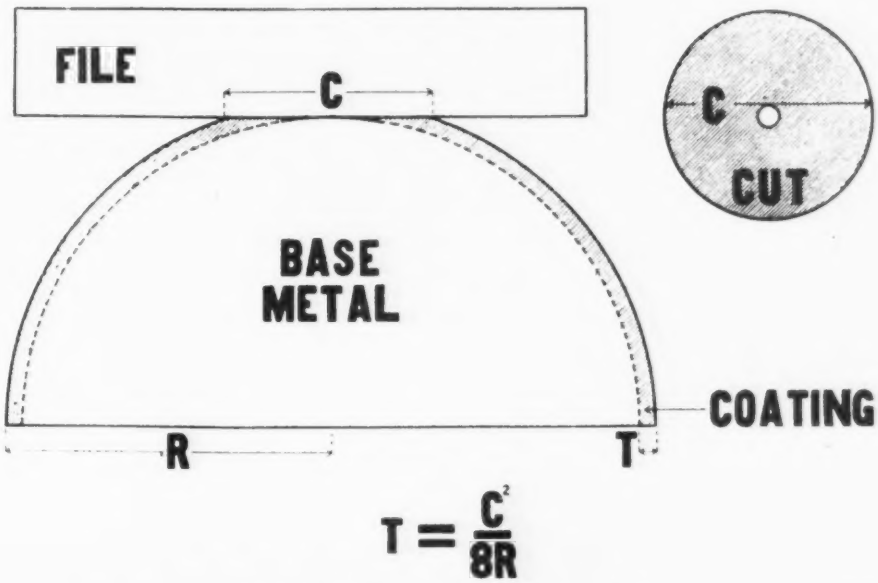


Fig. 6. The chord method for convex surfaces.

of the time required at a given temperature for a corrosive solution to penetrate a metallic coating or by carefully timing several successive dips, each of which removes a layer of deposit of known thickness. They are simple and the apparatus required is not expensive. They all have one thing in common, namely, that the surface of the deposit must be very clean when the test is started. The coating is destroyed, but in most cases it is possible to strip and replate the article.

(a) Immersion Tests

There are a number of immersion tests in use today, some of which have been carefully standardized and are reasonably accurate, while others are of little value as absolute measurements. Most of these methods are for the softer metal coatings such as zinc, cadmium and copper.

One method in particular which is valueless for specification purposes is the immersion of a cadmium plated article in an acidified antimony chloride solution. A stop watch is started at the instant of immersion and stopped when gas evolution ceases. This test cannot be standardized for general use, as cadmium coatings from different baths dissolve at different rates. Even equally thick coatings from the same bath, if deposited at different current densities, may dissolve at different rates. In addition to this serious fault, the test, because of its nature, gives the maximum thickness rather than the minimum.

An immersion test for copper has gained rather wide usage among manufacturers of aircraft gears which are copper plated to prevent case carburization on certain areas. It consists of dipping the article in a solution of chromic acid which has been acidified with sulfuric acid. Neither the origin of this test nor any accepted standardization of it is known to the author. It will, however, search out the points of minimum thickness, and under controlled conditions and with proper standardization should be useful.

The Preece Test has been specified a great deal in the past as a uniformity test for zinc coatings (particularly hot dipped coatings). It consists of immersing the zinc coated article for successive one minute dips in a standard solution of copper sulfate which has been adjusted to a specific pH (3.3), rinsing and rubbing with a brush or swab between dips. The appearance of a bright, adherent copper deposit on the exposed steel base is the end point of the test. Inasmuch as zinc coatings prepared by different methods dissolve at different rates, this method should be used only to determine the uniformity of the coating. In its standard form, it reacts too rapidly for use on most electro zinc deposits.

A test for the thickness of chromium deposits has been developed in which a drop of concentrated hydrochloric acid (Sp. Gr. 1.180) is placed on the chromium surface at a known temperature. A stopwatch is started at the instant the acid begins to attack the chromium, as evidenced by gassing the drop. The watch is stopped wh the gassing ceases, and the thickness calculated from a graph (Fig. 7). Th test is applicable to chromium coatin up to 0.00005" thick.

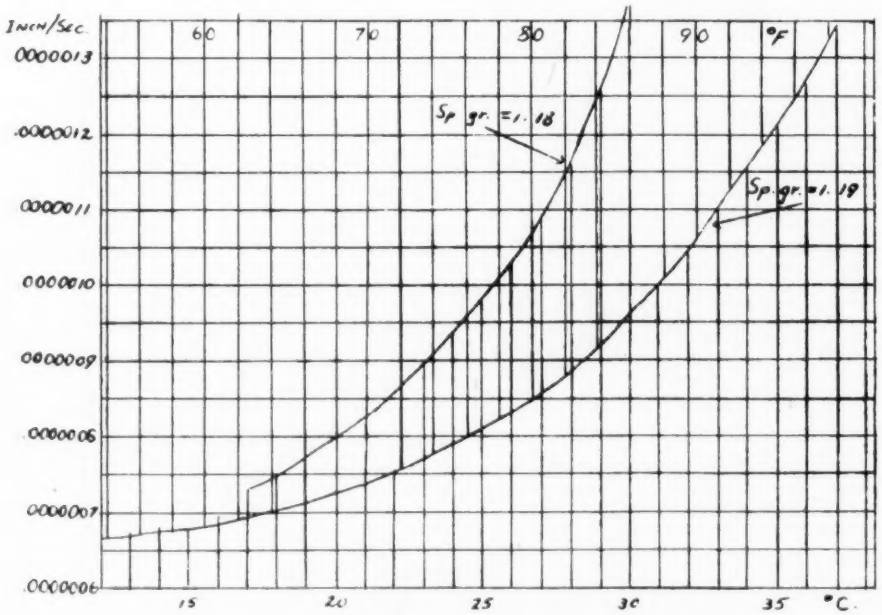


Fig. 7. Graph for drop test for chromium deposits.

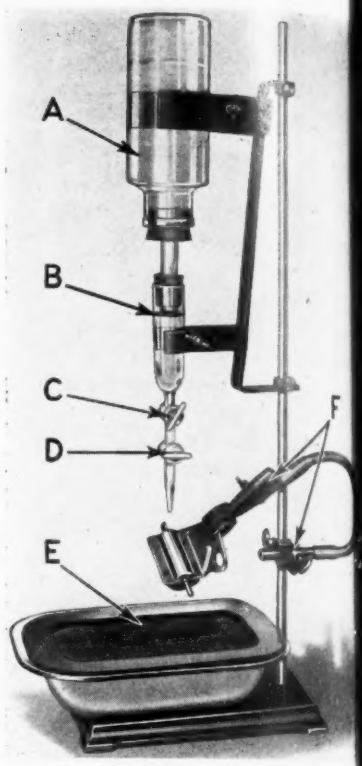


Fig. 8. Drop test or jet test apparatus constant liquid level device attached

(b) Dropping and Jet Tests

Dropping and Jet Tests are wid used for measuring the local thi nesses of various electrodeposits. Th are minimum thickness tests only the point of minimum thickness known. The first dropping tests a believed to have been developed England approximately ten years a for cadmium coatings. Since that ti the test has been improved and appli to other coatings. Generally th tests are accurate to plus or min 10%.

The apparatus (Fig. 8) in its si plest form consists of a separatory fu nel with two stopcocks instead of o The outlet tube is drawn to a sm tip. One stopcock is used to start a stop the flow of reagent and the ot is set to adjust the flow so that 90 110 drops per minute fall from the t The article to be tested is held a sho distance below the tip in such a po tion that the surface is at a 45° ang to the vertical. A stop watch is start at the instant the first drop strikes t plated surface and is stopped when t

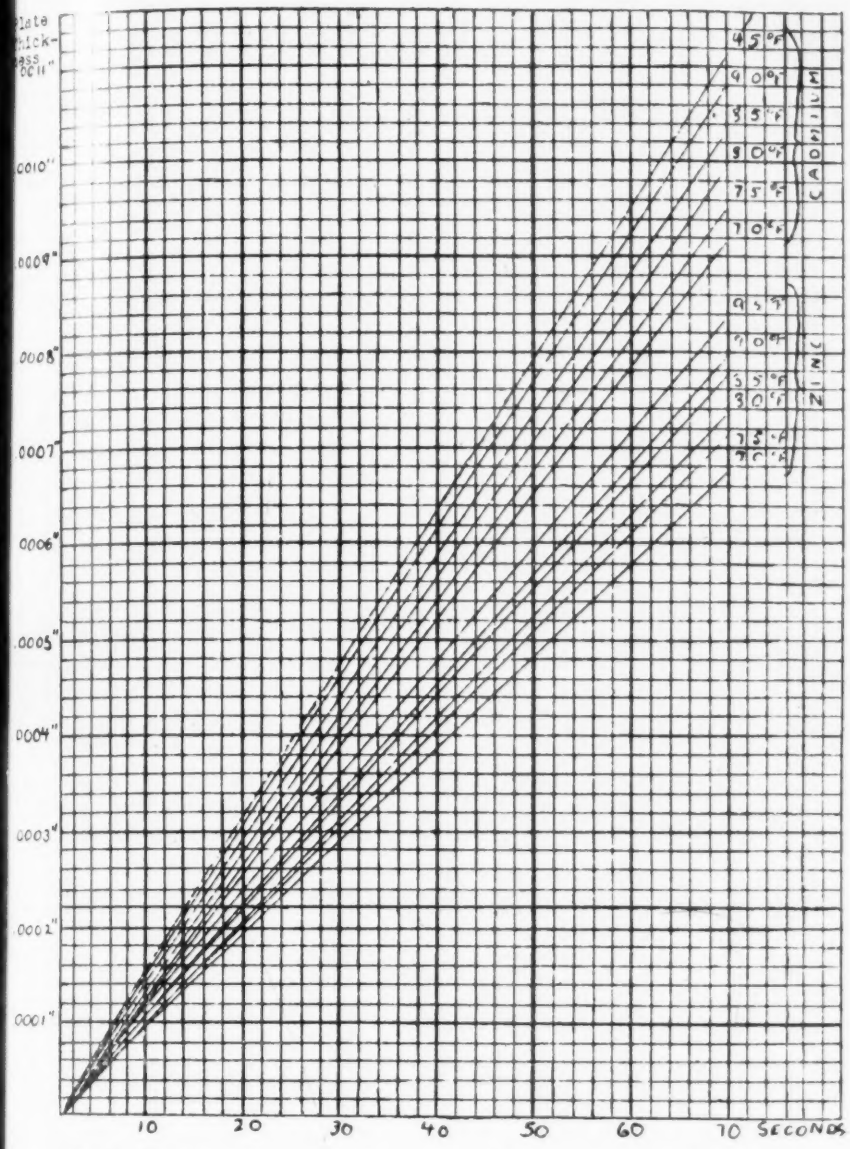


Fig. 9. Time-temperature-thickness graph for chromic acid dropping test.

basic metal is exposed. This method was first standardized in this country by Hull & Strausser using ammonium nitrate solutions acidified with hydrochloric acid for cadmium and with nitric acid for zinc. The solutions were adjusted so that they required 10 seconds to penetrate 0.0001". More recently, a solution of chromic acid acidified with sulfuric acid has been standardized for both cadmium and zinc, this solution being less sensitive to small variations in physical and chemical properties of the deposits. Results are obtained from a graph shown in (Fig. 9). Other reagents have been developed for determining the thickness of copper, tin, silver and lead deposits.

Various modifications of apparatus have been used to simplify control of the rate of dropping.

The Jet Test which is commonly used in England is very similar to the dropping test. A fine stream of the corrosive reagent rather than a series of drops is impinged against the deposit. In addition to the metal coatings mentioned above, this test has been extended to nickel and composite copper-nickel coatings on steel, brass, aluminum and zinc base metals. It should be noted, however, that bright nickel deposits from certain types of baths dissolve at abnormal rates.

Weighing Methods

These methods are usually employed to determine the average thickness. Except on deposits which are known to be of uniform thickness, and on small objects plated with precious metals such as gold, other methods are more suitable for specification purposes. An analytical balance or volumetric analytical apparatus and operator skilled in their use are necessary.

Briefly, two general procedures are used. One is to weigh the plated article, strip off the coating in a reagent which will not attack the basis metal, and reweigh. The second procedure is to strip the coating in a reagent which may or may not attack the base metal, then analyze the reagent chemically to determine the amount of coating dissolved. Knowing the area of the surface stripped, the weight of the coating on this area, and from tables, the weights of different coatings per unit area for a unit of thickness, it is a simple matter to calculate the average thickness of deposit.

Magnetic Methods

Magnetic methods have come into rather wide use in the last few years. They have one great advantage over most other methods in that neither the deposit nor the basis metal is destroyed. In addition to this, the methods are rapid. These methods, however, are not applicable to all combinations of metals. Generally, they are applicable only to non-magnetic coatings on magnetic basis metals and to magnetic coatings on non-magnetic basis metals. An exception to this is the measurement of nickel coatings on steel, which is possible because of a considerable difference in the magnetic properties of these two metals.

Two general types of instruments are available. One, represented by the Magne-gage (Fig. 10) utilizes a permanent magnet, and measures the relative force necessary to separate the magnet from the object. From this measurement, the thickness is read on a graph which is supplied with the instrument. Certain precautions must be taken, or appreciable errors may be encountered. Rough deposits or rough

(*Continued on page 638*)

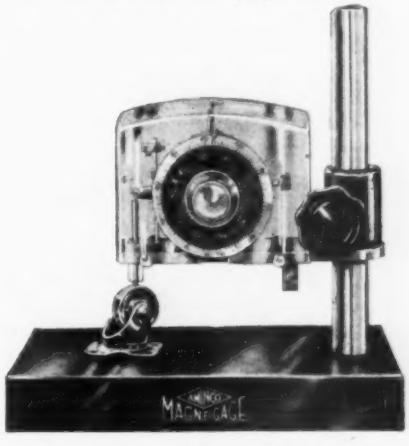


Fig. 10. The Magne-Gage.

Metallizing Non-Conductors

By SAMUEL WEIN

New York, N. Y.

PART 2

Types of Bonding Mediums

A BONDING medium is considered to be any medium which (a) can be applied to the given surface and the conducting medium subsequently applied to it, or (b) the bonding medium may be mixed with the conducting medium and this in turn applied to the given surface. The bonding medium may be wax, resins, etc., etc. Obviously, different types of bonding mediums permit different types of processing, and these will now be discussed.

Natural Gums

The natural gums are used primarily because they are readily soluble in convenient solvents, and because they permit ease of incorporation between high or low concentration of the resin in the solvent with a suitable material having high conductivity.

The following data were compiled from Allen's Commercial Organic Analysis, Volume IV; Chemical Buyers Guide Book; and Merck's Index.

Gum Acacia. Yellowish white to light amber, slowly and almost completely soluble in 2 parts of water.

Gum Accroides. Red in color, soluble in hot alcohol.

Agar-Agar. Dried mucilaginous substance, soluble in hot water to a viscid, tasteless, odorless jelly. Swells in cold water, but does not mix.

Gum Ammoniacum. Irregular rounded tears, yellowish or brownish in color. Brittle when cold, but soft when warm. Has a peculiar odor. Partly soluble in water, alcohol, ether, vinegar and alkaline solutions.

Gum Asphaltum. Black solid mass, melts in different grades from 100 to 350° C. Soluble in benzol, alkalies and alkali carbonates.

Gum Benzoin. Balsam resin, yellowish or brownish tears, brittle. The melting point varies between 77-100° C.

Rosin. Pale amber, brittle; softens at 70-80° C. Soluble in methyl, ethyl and amyl alcohol, acetone, etc.

Gum Congo. Yellow to yellowish brown; soluble in benzene, oil of turpentine, etc.

Gum Copal. Fossil resin, white through shades of yellow, red to brown and black. Melting point from 95-305° C. 96% soluble in alcohol, oxidized turpentine, alkaline solutions.

Gum Dammar. Soluble in turpentine, benzol, etc. Melts at 302° F., softening at 167° C.

Dragon's Blood. Red irregular lumps; melting point 120° C. Readily soluble in alcohol and ether.

Gum Elemi. Transparent, soft, yellowish granular masses, partially soluble in cold, but completely soluble in hot alcohol.

Gum Ester. Glycerine derivative. Boiling point 290° C. Soluble in amyl acetate.

Ethyl Cellulose. White granules, soluble in acetone, etc.

Gum Gamboge. Grayish or grayish-brown amorphous cylinders, soluble in acetone, alcohol, benzene, etc.

Gelatin. Amorphous, white, brittle, transparent sheets, flakes or coarse powder. Soluble in hot water, glycerine; swells up in cold water.

Gum Guaiac. Brown irregular lumps; melts at 85-90° C. Easily soluble in alcohol, solutions of alkalies.

Gum Karaya. White to gray powder.

Gum Kauri. Yellow, amber-like resin; melts at 182-232° C. Soluble in alcohol, turpentine; insoluble in water.

Gum Kino. Soluble in alcohol, slowly soluble but incompletely in hot or cold water.

Gum Manila. Yellowish-brown masses; melts at 190° C. Soluble in alcohol.

Gum Mastic. Dull yellow grains; melts at 108° C. Soluble in alcohol, acetone.

Gum Pontianak. Melts at 135° C. and soluble in turpentine, alcohol, benzene, etc.

Rubber. White, yellowish-brown cakes, balls; melts at 125° C. and soluble in carbon disulphide, absolute alcohol.

Gum Sandarac. Clear yellow drops, harder than mastic; liquefies at 160° C. Soluble in alcohol, acetone.

Shellac. Orange, yellow and white. Soluble in alcohol, borax and alkalies.

Gum Tragacanth. White amorphous; soluble in alkaline solutions.

Of the synthetic resins, those belonging to the groups which form hard films when dried or polymerized, such as phenol-formaldehyde, urea, melamine, etc., all serve well for the purpose.

Franklin recommends gum Arabic, gum dammar, and gum tragacanth with bronze powder.

Shellac films are used because they have a high melting point, because thin films can be applied to a given surface and because the chance of *lifting* from the surface is less apt to happen than if other materials are used in its stead. Further, shellac films will fill the pores of a given material more readily, thus making it a really convenient all around material to use.

The advantage of using shellac rather than lacquer lies in the higher solids content of the former, which permits of filling pores with fewer coats and the stronger adhesion of shellac to smooth surfaces. Shellac has one important disadvantage, however, in that commonly applied bronzing powder in nitrocellulose lacquer does not cover it well when brushed, although when the bronzing solution is sprayed on, no trouble is experienced. If it is necessary to brush on the bronzing lacquer, an intermediate coating of boiled linseed oil should be applied and allowed to dry overnight. This, of course, increases the time required for preparation. When the silver sulphide method is used, the shellac does not have the above mentioned disadvantages.

For articles which are not very porous, such as sea shells, baby shoes, rubber, etc., both shellac and lacquer are used, the latter having the advantage of quicker drying. As explained above, if the bronzing lacquer is to be applied by brushing, a lacquer base is more desirable.

Shellac, rosin and the copal gums can be used to good advantage here. These are soluble in alcohol, benzene, etc. These solutions may be applied by dipping, brush or spray, leaving the film somewhat tacky and while it is in that condition, the bronze powder is brushed onto it, the excess metal powder is brushed off, and allowed to dry, when it is considered to be a good conducting film for plating purposes according to Re, Schore, etc.

If leather is to be treated, say in the form of baby shoes, which by the way is one of the most generally plated of all non-conducting materials, it is usually given three coats of the shellac

Part I appeared in the September issue.

lution, with an hour between each
t. Some experimenters suggest plac-
in an oven at low temperatures for
out 12 hours.

Re recommends that the baby shoes
first cleaned before treating with
shellac, and this cleaning compound
made up of:

Borax	3 ozs.
Sodium carbonate	1 oz.
Caustic soda	⅛ "
Black whale oil soap	⅛ "
Water	1 gal.

The temperature of the solution is
tween 90 and 95° F. The shoes
ould be scrubbed thoroughly with
s solution using a tampica scrub-
g brush. After cleaning, the work
ould be thoroughly rinsed with warm
ter, then dried. Subsequently the
ed shoes are treated with shellac
lution.

Work that has deep recesses and
h projecting parts should have a
t of varnish, brushed on well and
nly applied. It is then set aside for
out 1 hour, after which it has be-
me tacky and ready for the conduct-
g bronze powder. A good varnish
mposition is:

Copal varnish	1 part
Turpentine	3 parts

Seller suggests the following paint:

Linseed oil	5 parts
Turpentine	5 "
Bone black	250 "
Rosin	180 "
Graphite	420 "

These materials are mixed in a peb-
e mill, and are applied to the surface
th a brush, dried and subjected to
drying temperature of 80° C.

Consul-General George W. Roosevelt
riting from Brussels, reported as
rly as 1907, that a process accredited
Monge and Arzano plated flowers,
c. The details of the flower stem,
c., were excellently well reproduced.
and A. Hart of Indianapolis, Ind.,
d Los Angeles, Calif., represented
ese firms in the United States. No
tails of the process were given.

Waxes

yberry. Also known as "myrtle wax." Vegetable; light green; melts 45-46° C.; slightly soluble in alcohol.

eeswax. Derived from insects; yellowish to brownish-yellow, melts at 62-65° C.; soluble in benzol.

andelilla. Vegetable; brownish to yellowish-brown; melts at 68-70° C.; soluble in oil, turpentine, carbon tetrachloride.

Carnauba. Vegetable; hard, amorphous, light yellow to pale, dirty green, brittle lumps; melts at 84-86° C.; soluble in ether, boiling alcohol, hot oil, turpentine.

Ceresine. Also called Ozokerite. White and dark yellow; mineral; melts at 61-78° C.; soluble in 35% alcohol, benzol, hot oils.

Chinese. Insect; white to yellowish-white; melts at about 81° C.

Japan. Vegetable; pale yellow, flat cakes; melts at 49-55° C.; soluble in benzol, carbon disulphide.

Montan. Dark brown to white lumps; melts at 80-86° C.; soluble in benzol.

Palm. Yellowish amorphous mass; melts at 102° C.; soluble in ether, alcohol, alkalies.

Paraffin. White semi-transparent; mineral; melts at 48-62° C.; soluble in benzol, oils, turpentine.

Parawax. Same as paraffin; melts at 51-58° C.

Spermacetti. Pearly white; melts at 45-50° C.; soluble in boiling alcohol.

Stearic Acid. White powder; melts at 55° C.; soluble in boiling absolute alcohol.

Synthetic hydrocarbon solids with wax-like properties and with melting points in various types up to about 400° F. are also available from various sources.

Application

A very simple compound for waterproofing porous articles is made up of:

Beeswax	1 part
Paraffin	3 parts
Rosin	½ part

The melting point of this composition is about 200° F. and the work should be immersed for about 20 to 30 minutes, after which it is removed and the film allowed to congeal.

The next operation is to apply a thin coat of shellac, which is allowed to dry thoroughly. Two coats of the following mixture are then applied by spraying:

Plater's copper bronze powder	3 ozs.
Cellulose lacquer free from gum	¼ pint
Lacquer thinner	¾ "

This combination is mixed by adding the bronze powder to a thinner, stirring thoroughly, and adding the lacquer.

The shellac may be brushed upon the work by using a fine camel-hair brush, or sprayed with a gun. In spraying the bronze powder it is best to let the first coat dry for an hour or so before applying the second coat. After the second coat is allowed to dry for 2 or 3 hours, the work is ready for the plating operations.

With less porous articles all that is necessary is to apply two coats of shellac, letting them dry thoroughly, and then to spray the copper bronze powder mixture. In spraying the copper bronze mixture, the spray gun should not be held too close to the work, and the surface should not be flooded. If the spray gun is operated properly, the bronze powder mixture will set almost as fast as it is applied.

Electrotypes are duplicate letter press printing plates and, according to Winkler and Blum, find general use in the printing industry. High speed rotary letter press printing is done exclusively from electrotypes.

The fundamental electrotyping process is illustrated in the production of wax molded copper electrotypes. The wax is melted in steam jacketed or electrically heated (immersion unit type) kettles. Two typical pre-war compositions used for wax mixtures are as follows:

1)	Hard green Austrian Ozokerite	80 lbs.
	Candelilla wax	6 "
	Rosin (water white)	14 "
2)	Brown Ozokerite	70 lbs.
	Beeswax	22 "
	Burgundy pitch	8 "

Upon continued use and remelting, the wax mixture tends to become dry and hard. Its surface will not retain enough graphite if too dry, and the molding properties are unsatisfactory if it is too hard. To soften an old mixture, additions of substances such as Burgundy pitch, gum thus (olibanum), castor oil, motor oil, etc., are made empirically until a suitable consistency and tackiness is obtained. During the winter months, the composition is softened by adding gum thus or Burgundy pitch. During the summer months, candelilla wax is added when necessary to harden the mixture. Powdered graphite, or zinc oxide, or lamp black may be used to dry the wax, if it becomes too tacky. Since imports of ozokerite were stopped in 1940, a hard brown ceresine-like wax, a domestic petroleum product, has been found to be an admirable substitute. This material is a micro-crystalline wax, having a melting point of 170 to 174° F. It may be used directly, or with small additions of the various materials, discussed above, to improve the workability whenever desired.

Graphiting is done either by dry brushing (polishing) or by suspension of graphite in water (wet leading). Usually both operations are performed, the dry polishing prior to the wet leading. Today, machines perform the coating with graphite as the wax passes through the machine on an endless belt carrier.

In plating plaster of Paris, Schore recommends inserting a screw in the base of the casting, while the plaster is setting, and flush with the bottom where it will not show in the assembled and finished job. This screw can be fastened to a rack and left on it throughout the whole procedure.

Treleuben suggests submerging the object in molten stearic acid for a few minutes, spraying with Bakelite lacquer after removal, and at once applying gold or copper leaf. The object is then ready for plating.

Metal Powders

Adams sprinkles finely divided metallic tin over the warm wax surface. When the wax is cold, the excess tin is removed and the surface polished with a fine soft brush, washed with running water, then with alcohol and it is ready for plating. Schore used this method with encouraging results.

Rubber, Gutta Percha and Asphalt: These materials are soluble in benzol, turpentine, etc. Hence, thin or thick solutions can be made to suit the individual requirements. Objects may be treated with such solutions and the solvent allowed to evaporate, this being repeated two or three times according to the porosity of the article being treated. When the last coat is still tacky, bronze powder may be rubbed in with a soft brush or the fingers. If too tacky, the bronze powder will become lumpy; if there is not sufficient tackiness, the surface will be bright indicating insufficient bronze powder.

Newton softens gutta percha in warm water and it is worked well with the hands until it is quite soft, graphite being mixed in well during this kneading process.

Goldberg forms a solution of gutta percha using benzol as the solvent, and into it is incorporated the copper powder. Such solutions may be spread, sprayed or brushed onto plaster castings, and when the solvent has volatilized, they are ready for plating.

Kendall makes a mold of:

Beeswax	⅔ parts
Gutta percha	⅓ part

These materials are melted together, and subjected to pressure against an original pattern.

Warren adds salts of metals, such as zinc, nickel, tin, gold or silver to rubber and vulcanizes it at temperatures between 300° to 330° F. for at least 1 hour, at this stage. The metallic salts are converted to the metallic sulphides, and the article may then be plated.

Cellulose Lacquers: The varnish types of lacquers have been superseded entirely by synthetic film forming mediums, and in particular such compounds as cellulose nitrate, acetate, butyrate, etc., etc. These are water white (transparent), relatively low in viscosity and in total solids.

The cellulose lacquers can be used for spraying and brushing. These are excellent with respect to adhesion to the object and will not become brittle with time. The drying time after a film has been applied is rapid and the films are hard.

These solutions, with the metal powders added, must not be kept for long periods of time because of the acid nature of the lacquer medium, affecting the metal powder and causing gelling.

A method of improving the adhesion of the metallizing powder to wax comprises the incorporation of a fatty acid such as stearic or oleic acid and is patented by Hunter, a typical formula consists of:

Bronze powder	90 parts
Zinc powder	10 "
Stearic acid	1 "

This mixture is used to metallize the original phonograph records for subsequent plating.

Copper powder suspended in lacquer is probably the most popular method of metallizing and is used for baby shoes and other articles which require no exact dimensional reproduction. The bronzing mixture consists of the following:

Nitrocellulose lacquer	1 fl. oz.
Lacquer thinner	7 "
Copper bronze powder	2 ozs.

Only enough for immediate use should be prepared, since the metal powder often causes the lacquer to gell. The lacquer should be low in gum (less than 5%) and should be added after the thinner and powder have been well mixed.

When spraying, the gun is not held close enough to flood the surface but at a distance so that the film dries, almost as soon as it is applied. The surface must be dull when dry. If glossy, it indicates that the copper is coated by a layer of lacquer which will prevent the passage of current. When completely covered (two coats are usually sufficient), the article is allowed to dry for 1 to 2 hours, fine wire is attached at a few points for distribution of the current and the object is plated in the regular acid copper sulphate bath.

Old fashioned layden jars (condensers used in wireless telegraphy, X-ray work, etc.) were plated with copper according to Moreland. These layden jars are made of glass and the surface was etched slightly in order to make the film adhere better. The metal film consisted of:

Bronze powder	1 lb.
Lacquer	1 gal.

The glass was sprayed with this solution and allowed to "dry" and it was then ready for plating.

Ruben uses an alloy of copper powder 70% and zinc powder 30% with a solution of cellulose nitrate in amyl acetate. This is applied to the given surface, and when dry, is subjected to the vapors of hydrochloric acid. The resistance drops to a few ohms, and the article is then ready for plating.

Another, and probably simpler method is to make a solution of:

Lacquer	1 part
Thinner	4 parts
Bronze powder	q. s.

Work which is not deeply undercut may be first sprayed with a mixture of:

Tin powder	2 ozs.
Bronze medium	½ pt.
Bronze medium thinner	½ "

The tin powder is useful in disclosing bare spots in the copper powder coat which follows. The parts are allowed to dry for 1 hour and sprayed again, this time with a coat of

Copper powder	3 ozs.
Bronze medium	½ pt.
Bronze medium thinner	½ "

The work is then dried in air for 3 to 4 hours, after which it is ready for plating.

Glyptal: Varnishes of the glyptal resin series are used extensively for this purpose. The keeping qualities of these is equal to the corresponding cellulose products.

Gelatin Compounds: Hogaboom and Hall suggested an effective collodial graphite mixture termed "Aquadag," suspended in gelatin. Such a stock solution may be made of 1 percent gelatin and 0.01 percent potassium dichromate solution. One part of this mixture together with one part of Aquadag and two parts of water gives the following combination:

Colloidal graphite ...	4½%
Gelatin	0.25%
Potassium dichromate	0.0025%

This can be applied with a soft brush, rubbed well into the pores of the product and allowed to dry, after which the article may be plated. Two or more coats of the graphite compound may be applied if desired.

Fish glue is recommended as a colloid to hold bronze powder, by Franklin.

Miscellaneous

A series of compounds containing metallic silver powder has recently been announced by du Pont, which may be used without additional preparation or formulation, for application to glass, porcelain, steatite, plastics, wood, cloth and paper. Aging or exposure to sulphide vapors has only a slight effect on the high conductivity. These films which are a dull metallic gray, can be applied by spraying, dipping or brushing, followed by air drying, and, in some cases, baking.

A number of coating materials with different characteristics have been formulated. The differences in each are intended to meet certain requirements such as the base material to be coated and certain degrees of adhesion and film toughness. These materials, which are described briefly below, include a conductive-coated cloth and a flexible conductive film. Of these No. 4132, No. 4489, No. 4503, and No. 4530 are in commercial production. The others are available as laboratory samples. There is also a thermoplastic conductive cement which is available by special arrangement.

No. 4530 is recommended for non-porous or primed base materials such as steatite, porcelain, glass and painted wood. Good scratch resistance.

No. 4548 is recommended for non-porous or primed base materials such as glass and Bakelite. Fair scratch resistance, or good scratch resistance with baked cover lacquer AW-84.

No. 4549 is recommended for cloth. Good abrasion resistance and flexibility.

No. AX-61 is a conductive cloth which is slightly affected in resistance by folding.

No. 4503 is suggested for non-porous or primed base materials such as glass, porcelain and steatite. Excellent scratch resistance. Requires baking at 140° C.

No. 4132 is used for non-porous or primed base materials such as ceramic tile, painted or varnished wood. Fair scratch resistance.

No. 4489 is intended for plastics such as "lucite" and cellulose acetate. Good adhesion.

No. AX-91 is moderately flexible.

A thermoplastic cement is offered and termed No. 4561.

A "cover coat" lacquer medium corresponds to No. 4562.

Silver paint No. 25 as made by the American Ceramic Labs. Inc. appears to be a thin paint consisting of finely powdered metallic silver held in suspension in a cellulose ester lacquer. This is applied to the given surface by means of a spray gun with an adjustable nozzle, mainly to control the thickness of the film sprayed. The piece so treated is set aside to "air dry" (10 to 20 minutes) or for fast drying it can be placed in a drying oven at a low temperature.

Films of metallic lead are used mainly for X-ray filters as well as for similar short wave radiation.

Metallic lead films may be applied to any given surface simply by adding a sufficient percentage of "flake-lead" in a suitable binder. Flake lead is obtainable commercially in the form of a very fine and flocculent flake-like powder and the binder may be Carbozite gum, or any other of the binders in this group. High percentage resin solvents should not be used with lead flake. These solutions like the foregoing may be applied to the given surface by means of brushing, dipping or spraying. On drying, the film will be seen to be a series of tiny little metal flakes of metallic lead, overlapping one another to form an almost homogenous mass or film of metallic lead. This sort of film is soft and has a decided metallic lustre and a somewhat high reflective surface. Further, such films are acid resisting.

The dry powder may be sprayed from a nozzle such as electrotypers use when spraying graphite-water solutions. Subsequently the material so treated is subjected to an increase in temperature so that the lead will form a continuous film throughout its entire area.

Peano adds metal wool to plaster of Paris.

Gay incorporates metallic powders into a clay mass, molds it under pressure and "fires" it in the kiln, the article then being ready for plating.

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A Sulfate-Chloride Solution for Iron Electroplating and Electroforming

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Introduction

RESTRICTIONS in the use of various surfacing metals recently have caused considerable interest in electrodeposition of iron as a substitute metal. The investigations on iron electrodeposition described in this paper were prompted by restrictions on the uses of copper and nickel in the electrotyping and stereotyping industry.

This work at Battelle Memorial Institute was part of a broad research program on the improvement of electrotypes and stereotypes sponsored by Printing Plates Research, Inc. Since the saving of copper and nickel is of such pressing importance, the members of Printing Plates Research have generously consented to publication of the results in order to aid not only others in the printing industry, but other industries where the results may be applicable.

The greater part of the experimental work was confined to the development of an iron plating bath and methods adaptable to electrotyping and surfacing of stereotypes. A combination sulfate-chloride bath was developed and tried out on a commercial scale in several electrotype foundries with considerable success. Later, a more thorough study of the properties and behavior of this sulfate-chloride bath was made in order to determine other possible applications.

Previous Investigations

A limited amount of experimental work on the electrodeposition of iron and iron alloys has been reported by various investigators in the past. The greater part of this work was confined to such applications as the building up of worn machine parts,[1, 2, 3, 4] the electrolytic production of iron sheets and tubes,[5, 6, 7, 8] and electro-refining.[9, 10] Past references have been concerned mostly with iron baths based on either ferrous sulfate or ferrous chloride, usually with generous additions of various other salts.

Some interesting applications in the electroforming of iron have been developed in the past few years by the United States Rubber Company.[11, 12] The process has been applied to the manufacture of molds for tires, plastic molding, die-casting, etc. No data on the plating solutions used have been found in the literature to date. However, the rate of deposition has been reported to be about 0.001 in. or 25μ per hour, which is comparatively very slow. Iron plating practice up to 1941 has been discussed by Thomas.[13]

Electrodeposition as used in the printing industry is confined mostly to electrotyping, a highly developed electroforming process. Strictly electroplating processes, however, are used in surfacing stereotypes and other printing plates, usually with nickel or chromium as the surfacing metals.

As far back as 1870 some iron electrotypes were actually produced in Russia.[14] The rate of deposition, however, was so slow that weeks were required to build up even thin shells.

Iron electrodeposition has been used for many years at the Bureau of Engraving[15] at Washington, D. C., in the reproduction of intaglio plates.

A somewhat recent Russian publication[16] reports successful production of iron electrotypes from lead molds, using a ferrous sulfate-sodium chloride bath at a temperature of 215° F. (102° C.).

Lamb and Blum[17] have developed a chloride iron solution which is now used at the U. S. Government Printing Office, as a substitute for nickel plating, and to replace part of the copper in electrotyping.

Instructions in the application of the sulfate-chloride iron bath to electrotyping and to surfacing of stereotypes have been given briefly by the authors[18] in a previous publication.

An excellent review of iron plating, with extensive bibliography, has been prepared by Cleaves and Thompson.[19]

Experimental Work

(a) Requirements

Electrodeposition as applied to electrotyping is subject to the following limitations: (1) Since a considerable amount of the work is done with wax mold cathodes, the plating salution must be usable in the temperature range of 70° to 115° F. (21° to 46° C.). (2) In making an electrotype shell, a removable nonadherent deposit is required. The metal, therefore, must be deposited in such a manner that no strains are set up in the deposit; otherwise peeling or separating, will take place. (3) The deposited electrotype shell must be ductile enough to permit stripping from the mold without breakage. (4) The plating solution must be stable and not too difficult to maintain. (5) The plating solution must be capable of rapid deposition. (6) If used for surfacing stereotypes and other printing plates, the plating solution must produce a smooth deposit, free of pits or roughness.

(b) Preliminary Tests

In preliminary tests none of the known iron plating solutions fulfilled all of the above conditions. Principal difficulties encountered were caused by excessive brittleness of the deposit, peeling and cracking, pitting (especially in surfacing stereotypes), dark deposits or "burning," insufficient throwing power, insufficient stability for continuous use, and too slow a rate of deposition.

During the exploratory work to overcome most, if not all, of these troubles, 125 different iron solutions were tried. These were divided into three groups: (1) solutions based on ferrous sulfate, (2) solutions based on ferrous chloride and (3) solutions based on combinations of ferrous sulfate

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nd ferrous chloride. Additional constituents included a ide variety of salts and addition agents. Detailed data on hese baths would require considerable additional space, and ave therefore been omitted from this discussion.

The best results were obtained with a solution based upon he sulfate-chloride combination; hence, discussion will be mited to this particular composition.

(c) Bath Composition and Operating Conditions

The composition of the bath selected as most suitable for pplication to electrotyping and for surfacing stereotypes as found to be:

	g./L.	oz./gal.
Ferrous sulfate ($FeSO_4$—$7H_2O$)	250	33.0
Ferrous chloride ($FeCl_2$—$4H_2O$)	42	5.6
Ammonium chloride (NH_4Cl)	20	2.7

Commercial salts were satisfactorily used.

In making up the bath, it is advisable to reduce the solution with iron filings and acid prior to plating. After this reatment, a clear blue-green color is obtained. Ammonium ydroxide should be used to bring the pH up to the proper alue. Purification with activated carbon, followed by filtering, is desirable where smooth deposits are essential.

Details concerning preparation, tanks, anodes, etc., are overed in a previous publication.[18]

Electrotyping. Operating conditions for plating iron on ax and lead electrotype molds are: Temperature, 100° to 05° F. (40° to 43° C.). pH, 4.5 to 6.0. Current density, 0 to 100 amp./sq. ft. (5.3 to 10.7 amp./dm.^{2}). Anode rea facing cathode should be slightly less than cathode area. The voltage required depends, of course, upon the current density used and the anode-cathode distance. This istance should be about 4.5 to 5 in. (11.4 to 12.7 cm.). Under these conditions 4 to 6 volts will be required.

Surfacing of Stereotypes. For plating iron on stereotypes, he best conditions were: Temperature, room temp. to 90° F. 32° C.) pH, 3.5 to 5.5. Currrent density, 30 to 50 amp./q. ft. (3.2 to 5.3 amp./dm.^{2}). Anode area facing cathode hould be slightly less than face area of stereotype.

(d) Characteristics of the Bath

The effects of various operating variables, together with ther data pertaining to the bath, are described below.

1. Effect of pH. A series of plating tests were made, sing the bath at constant temperature and varying the pH or each test. Iron was deposited to a thickness of 0.003 in. 76μ) on a polished lead sheet (4 x 6 in.), which was previously treated in a solution of potassium dichromate and given a light coat of silver with a silvering spray. The ron deposit was reinforced with 0.003 in. to 0.004 in. (76 o 102μ) of copper, and then stripped from the lead sheet. A small sample was then cut from the iron-copper shell and mounted on a plastic base. The iron surface was polished o remove the thin layer of silver and to prepare the sample or hardness tests. Hardness was determined with a Tukon icrohardness tester.* The results of these tests are shown n the graph of Fig. 1.

2. Effect of Temperature. Test samples were prepared as n the pH-hardness tests, pH of the solution was held approximately constant, and the temperature was varied from 80° o 160° F. (26.6 to 71.0° C.). Results are shown in the graph of Fig. 2.

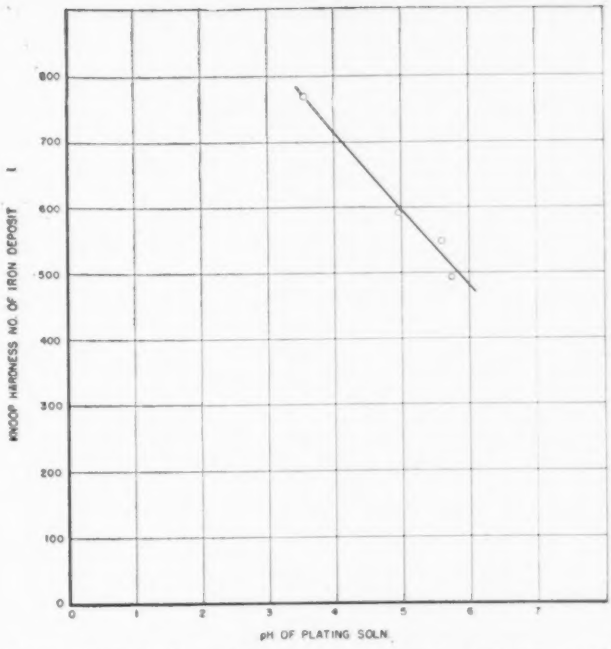

Fig. 1. Effect of pH on hardness of iron deposit. Bath temp., 110° F. (43° C.); current density, 6.45 amp./dm.^{2} (Knoop numbers are approximately equal to Brinell hardness numbers.)

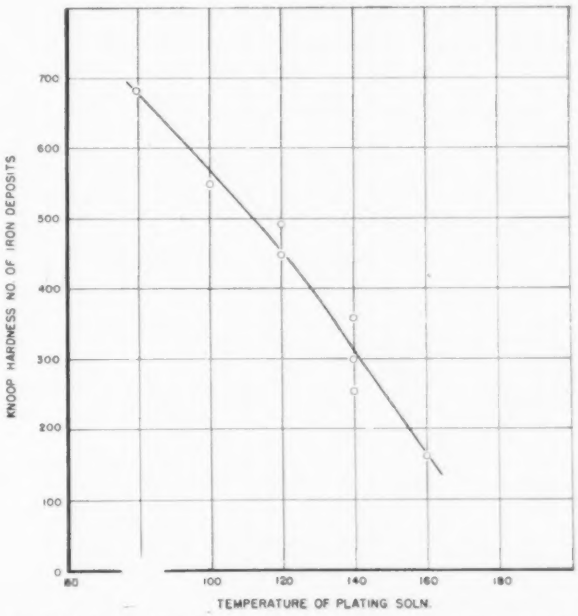

Fig. 2. Effect of bath temperature on hardness of deposit pH 6.6; current density, 6.45 amp./dm.^{2} (Knoop numbers are approximately equal to Brinell numbers.)

3. Throwing Power. As a means of getting quantitative data on the throwing power, the cavity scale test developed by L. C. Pan[20] was used. This test was chosen because it came nearest to simulating conditions obtained in electrotyping.

A copper bar was used for the cavity scale. Holes were drilled in the bar to depths ranging from 10% to 100% of the diameter.

Plating tests were made at a temperature of 110° F. (43° C.) and a pH of 4.7. Plating time was calculated to give a deposit thickness of 0.001 in. (0.025 mm.) over the normal area†. Anode-cathode distance was 2 in. (5.08 cm.).

For purposes of comparison, similar tests were made using an acid copper electrotyping bath at a temperature of 85° F. (19.4° C.).

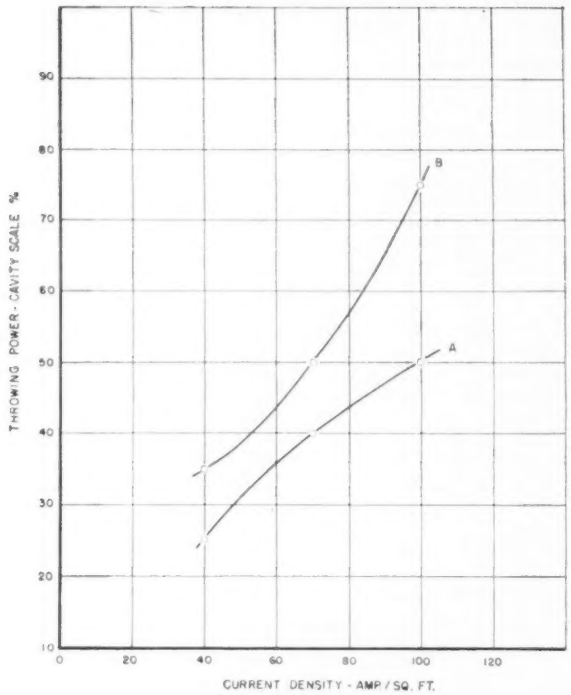

Fig. 3. Throwing power vs. current density for sulfate-chloride iron bath (A), and acid copper bath (B).

The results for various current densities are shown in the graph of Fig. 3. The percentage figures under Throwing Power refer to the depth in percentage of the diameter of the deposit hole, the bottom of which was completely covered with the deposit.

4. Cathode and Anode Efficiencies. Cathode efficiency was determined, using time-current-weight calculations. Tests were made at different current densities, the bath being operated at 110° F. (43° C.) with a pH of 6.0 to 6.6. Anode-cathode distance was 3 in. (7.6 cm.). Results are given in Table I.

TABLE I.—SULFATE-CATHODE IRON SOLUTION

Current Density (amp./sq. ft.)	Current Density (amp./dm.²)	Cathode Efficiency
20	2.15	96.4%
40	4.30	94.3
60	6.45	98.4
80	8.60	98.5

Average anode efficiency over this series of tests was found to be slightly greater than 100%.

5. Peeling and Cracking. Electrodeposits obtained in electrotyping are relatively nonadherent on account of the nature of the basis material. Peeling and cracking, therefore, take place much more frequently and under a wider variety of conditions than in the case of electroplating where an adherent deposit is obtained. This tendency toward peeling and cracking is an important factor in the selection of an iron bath for application to electrotyping, and also limits the conditions under which such a bath can be successfully operated.

Cracking is apparently caused by strains set up in the metal as it is deposited, and is followed by peeling when adherence is insufficient. In the case of the sulfate-chloride iron bath, it was found that these conditions may be caused by one of several of the following.

a. pH too low.
b. Bath temperature too low.
c. Current density too great.
d. Cathode too close to anode.
e. Too much ammonium chloride in the bath.
f. The use of certain organic agents.

When the sulfate-chloride bath is used for electrotyping a pH as low as 4.0 can be used without danger of peeling if the temperature is held around 105 to 110° F. (40 to 43° C.) and the current density does not exceed 50 amp./sq. ft. (5.3 amp./dm.²). At higher current densities and lower temperatures, the pH must be increased somewhat. For instance, when the bath is used at room temperature it is necessary to reduce the current density to 30 amp./sq. ft. (3.2 amp./dm.²), especially at the start, and to increase the pH to about 5.5 to prevent peeling.

Anode-cathode distance and an excess of ammonium chloride affect the tendency to peel somewhat, but these factors are not as critical as pH, temperature, and current density.

In electroplating, such as the surfacing of stereotypes where an adherent deposit is obtained, plating conditions can be varied considerably without encountering the problem of peeling and cracking. For this type of work, a pH as low as 3.5 can be used with the plating bath at room temperature and with current densities up to 50 amp./sq. ft. (5.3 amp./dm.²) without peeling.

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* The Tukon hardness tester to determine the Knoop numbers based on the diamond pyramid indentation. The tester is described in National Bureau of Standards paper R. P. #1220 and in U. S. P. 2,091,995. The tester can be procured from the Wilson Mechanical Instrument Company, 383 Concord Avenue, New York City.

† The "normal" area is width times length of plate.

(To be concluded in November)

Conservation of Chromic Acid and Chromium Salts

These conservation bulletins are prepared by the Operating Committee on Aircraft Materials Conservation and are designed to call to the attention of the aircraft industry general conservation problems and questions that require industry-wide support and action. The following conservation bulletin No. 16, was issued July 15, 1944.

Chromic Acid and Sodium Dichromate Situation

A RECENT survey by the War Production Board indicates that the requirements for chromic acid and sodium dichromate are such as to make the supply of these items extremely critical at this time. There is little hope for a substantial increase in production of these chemicals, and requirements for necessary uses will probably increase. Furthermore, there are no large stockpiles of either chromic acid or its salts. The necessity for conservation of these materials, by using them only in processes for which substitutes are not available, by reclaiming where possible, by avoiding waste, and by other means, is obvious. It is recognized that the problems involved in changing processes or chemicals, or in substituting proper procedures, are sometimes difficult, and this bulletin is prepared to assist the aircraft industry in conversion. Utmost cooperation by industry is required so that these materials will be available for essential uses and to avoid disruption of production.

General Conservation Measures

The use of all chromium chemicals should be dispensed with where practicable and alternative materials approved by the Procuring Agency (Army Air Forces, Materiel Command, Wright Field, Dayton, Ohio; Navy—Bureau of Aeronautics, Washington, D. C.) should be used. If a chromium chemical must be used, preference should be given to the use of dichromate rather than chromic acid. The latter is so scarce as to warrant the use of 2 pounds of sodium dichromate in order to conserve 1 pound of chromic acid.

Specific Conservation Measures Which May Be Put Into Effect Immediately

(a) The bright dipping of zinc by immersion in chromic acid should be discontinued. Brightness of zinc, merely for the sake of appearance, should be no consideration. Other treatments such as those approved as post treatments to zinc plating, required in Army-Navy Aeronautical Specification AN-P-32, may be used.

(b) Phosphate treatments should be considered in preference to chromic acid in the treatment of cadmium plating for paint adhesion. Although complete data are not available, it appears that phosphate treatments similar to those used on steel, generally of a few minutes duration, are suitable for this purpose.

(c) Army-Navy Aeronautical Specification AN-QQ-A-696 indicates the methods which are acceptable for anodizing, where anodizing of aluminum alloys is specified or desired. From a conservation point of view and subject to the restrictions in the above specification, the use of sulphuric acid is preferable if equipment on hand is adequate for this process. This bulletin does not intend to imply, however, elimination (after sulphuric acid anodizing) of the customary dichromate seal as necessary to obtain satisfactory corrosion protective properties in the anodic film.

A sufficient base for adequate paint adhesion on aluminum alloys may not necessitate, in some cases, an anodizing treatment. Under such circumstances, a chemical treatment forming a film with properties similar to those produced by anodizing in regard to the above requirement may be substituted. Where the use of such treatment is acceptable to the Procuring Agency, one of the following may be used:

(1) An approved alkaline dichromate process, best exemplified by the Alrok processes which are proprietary to the Aluminum Company of America.

(2) The chromadizing process, consisting of immersion of the thoroughly cleaned parts in a 5% chromic acid solution which is maintained at a temperature of 120-140° F. Time of immersion should usually be about 5 minutes, except for assemblies containing cadmium plated parts or castings containing integrally cast non-aluminum metal inserts where a 2- or 3-minute immersion should be used. It may be necessary in treating assemblies containing faying surfaces to add a wetting agent such as Aerosol OT to reduce the surface tension of the solution below 40 dynes per cm.

For landplanes and the interior surfaces of flying boats and amphibious airplanes, the alkaline dichromate process may be substituted for anodizing. As a further alternative, in certain types of applications as approved by the Procuring Agency, aluminum 2S and aluminum alloys 3S, 52S, 53S and 61S and alclad alloys may be chromadized in lieu of anodizing. Castings with integrally cast non-aluminum inserts which are not susceptible to anodizing may be given either one of the above treatments. Reference should be made to the latest issue of the applicable specifications of the Procuring Agency, particularly Army Specification 3-100 and Navy Aeronautical Specification SR-15, for complete up-to-date details.

(d) Large amounts of chromic acid are used for the stripping of copper coatings from steel. Inasmuch as several alternative methods are available, the use of chromic acid should be discontinued entirely. Among the alternative methods are electrolytic stripping in ammonium nitrate solutions, both acid and alkaline, and the alternate immersions in soluble sulphides and cyanide solutions.

Conservation by Controlling Operations

(a) The loss of chromium compounds by spray is encountered mainly in operations which make use of electric current, namely, chromium plating and anodizing. Compared to most other electrolytic processes, the chromic acid baths show very large spray losses because of their inherently low efficiencies at both the anode and cathode. In some cases, spray losses have been reduced materially by covering the surface of the bath with small airfilled glass cylinders or spheres, with short rods of polystyrene, or with squares of scrap methacrylate. A single layer of polystyrene cylinders,

¼" diameter, 2" long, cuts the spray loss in half, and a multiple layer is even more effective. A more general means of reducing spray loss is to install a recovery unit in the exhaust system returning the chromic acid to the tank. Action of this type is considered necessary inasmuch as it has been reported that in chrome plating from 5 to 10 times as much chromic acid is lost in spray than is actually transformed into chromium plate.

(b) Solutions containing chromic acid and chromates are very easily conserved by drag-out recovery. The treated parts may be rinsed in a drag-out tank containing water, operated without overflow, before it is rinsed in the regular rinse tanks. When the concentration in the drag-out tank has reached about 1/5 of the concentration of the treatment bath, the drag-out solution is removed from the drag-out tank and fresh water is put into it. The drag-out solution is then evaporated in a separate tank with steam coils or other heating means and the concentrate returned to the treatment tank. The drag-out solution may be used in some cases without concentrating it for restoring the level in the treatment tank.

In order to avoid the necessity for excessive recovery, it is desirable to minimize the volume of the drag-out as much as possible. This is accomplished by emptying all cup-like recesses which hold solution immediately on removal from the treatment bath and by allowing the articles to drain above the treatment tank before they are transformed to the drag-out tank.

(c) Dumping losses are encountered when a treatment bath gradually becomes contaminated with some reaction product. When the concentration of the contaminant reaches a certain critical value the bath is frequently dumped with consequent loss of active ingredient. This used to be universal practice and is still a common practice with chromic acid anodizing baths. The addition of sulphuric acid to the chromic acid anodizing bath has been reported to greatly conserve the strategic compound. Over 90% of the chromic acid consumed in current anodizing baths is used for bath control (to neutralize dissolved alumina and to maintain proper pH). It appears that the bulk of this is expended unnecessarily and could be satisfactorily replaced by sulphuric acid.

Maintenance of the anodizing in one case was as follows: A new bath was made up to 2.5% (21.5 pounds per 100 gallons) chromic acid solution. Additions of chromic acid were made when necessary to maintain a current density of not less than 1.5 ampere per square foot on aluminum alloy 24ST. When the concentration of the chromic acid reached 10%, further maintenance of the current density was made by additions of concentrated sulphuric acid, a current density of 2.3 amperes per square foot being considered maximum and the chromic acid concentration being maintained at not less than 10%. It is emphasized that extensive experience has not been had as yet with this type of replenishment which should therefore be used cautiously. It is important also to watch for corrosion of steel tanks which may occur under those conditions which permit high concentration of currents in localized areas of the tank, such as in tanks using glass plate liners where the glass plates do not completely cover the tank.

In any case, even with the conventional method of rejuvenating solutions by the addition of chromic acid, considerable saving can be effected by withdrawing only portions of the bath at regular intervals, and replacing them with suitable chromic acid solutions, rather than discarding the whole bath at one time. This method has several advantages: the quality of the anodized coating remains more constant; there are no interruptions of production; it is easier to dispose of small quantities of chromic acid at one time; and cost decreases. This general method appears applicable to any solution which contains considerable amount of active material when contamination reaches a limiting value.

Converting Facilities

The phosphate treatment used for paint adhesion requires no more equipment than is used for chromadizing.

The sulphuric acid anodizing baths require the use of rubber-lined, lead-lined or ceramic tanks. Lower voltages but much higher currents are employed than in the case of chromic acid anodizing.

Compliance With Government Specifications

Nothing in this bulletin shall be construed as permitting deviation from applicable Government specifications.

Patents

Alkaline Cleaner

U. S. Pat. 2,350,592. L. J. Comaschi, assignor to Campbell-Taggert Research Corp., June 6, 1944. A metal oxide corrosion inhibiting composition for forming cleaning baths for metal ware with tin surfaces having tin oxide coatings and with aluminum surfaces having aluminum oxide coatings comprising, sodium metasilicate 50 to 60 parts, sodium silicate (Na_2O:3.22SiO_2) 20 to 30 parts, and 20 to 30 parts of a material selected from the group consisting of sodium acid phosphate, sodium acid sulphate and sodium bicarbonate, all of said parts being by weight.

Phosphate Coating

U. S. Pat. 2,351,605. R. C. Gibson, assignor to Parker Rust Proof Co., June 20, 1944. In the process of coating metal surfaces by an acidic phosphate coating solution accelerated by a nitric, the step of including in the solution an acid which does not add to the PO_4 in the solution, and including said acid in an amount sufficient to counteract neutralization by the nitrite.

Example:

42° Nitric acid	200 lbs.
75% Phosphoric acid	1335 "
Zinc oxide	400 "
Water	To make 4,900 "

40 lbs. of the above are used to 100 gal. of water at 110-130° F., with 0.3% sodium nitrate per 100 gal. added as a 20% water solution.

Nickel Bath

U. S. Pat. 2,351,966. G. B. Hogaboom, assignor to Hanson-Van Winkle-Munning Co., June 20, 1944. A nickel depositing bath consisting essentially of an aqueous solution of nickel chloride and nickel acetate adjusted by hydrochloric acid to a pH value within the range of 2.0 to 5.5 electrometric, the total nickel content of the bath being from 4.5 to 17.0 oz./gal., of which 4.0 to 12.0 oz./gal. are supplied by the nickel chloride and from 0.5 to 5.0 oz./gal. are supplied by the nickel acetate.

Example:

Metallic nickel ..... 8.5 oz./gal.
(Half from nickel chloride and half from acetate.)
pH: 4.5 electrometric.
Temp.: 130-150° F.
C.D.: 15 — +400 amp./sq. ft.

Metallizing Ceramics

U. S. Pat. 2,351,974. M. Kollmar (Germany), vested in the Alien Property Custodian, June 20, 1944. A preparation for silvering the surfaces of ceramic ware by firing which comprises a flux, a solvent vehicle, silver, and a compound of a heavy metal whose oxide has a melting point higher than that of said flux, said heavy metal being selected from the group which consists of manganese, cerium, lanthanum, thorium, uranium, tantalum, and nickel.

Example:

Silver powder	20 g.
Basic bismuth nitrate	1 "
Resinic acid-manganese	4 "
Resin solution in oil of turpentine	75 "

The paint is applied, dried and fired at 730° C.

Plating Non-Conductors

U. S. Pat. 2,351,940. J. Dupuis (Belgium), vested in the Alien Property Custodian, June 20, 1944. Process for preparing articles for electrolytic plating comprising coating the articles with a coating composition containing a metal powder, allowing the coating to dry, immersing the articles in a solution containing approximately 10 grams of acetic acid and 90 grams of pyrogallic acid per liter of water, and then passing the articles through a separate solution containing 2 grams of mercuric chloride, 20 grams of silver nitrate, and 30 centiliters of commercial ammonia in a liter of water, and then rinsing the articles.

Example:

The following lacquer is applied:

Clear nitrocellulose lacquer	375 g.
Lithopone	75 "
Thinner	280 "
Copper powder	65 "

After drying for at least one hour, the lacquered article, preferably warm, is immersed in the acid dip and then into the silvering bath.

Corrosion Prevention-Magnesium

U. S. Pat. 2,352,076. C. J. Bushrod, assignor to Magnesium Elektron Ltd. (England), June 20, 1944. A process for the protection of magnesium and magnesium base alloys against corrosion, comprising first treating the metal with a solution, said solution containing principally manganous sulfate and being capable of forming a film of manganous hydroxide on the surface of the metal, then treating the metal with an aqueous solution of an oxidizing salt capable of oxidizing the manganous hydroxide to manganese dioxide.

Examples:

1. Potash alum ..... 20-30 g./L.
   Manganese sulfate ..... 20-80 "
   pH: Below 4.
   Time: 3 min.
2. Manganese sulfate ..... 80 g.
   Ammonium sulfate ..... 60 "
   Potassium dichromate ..... 40 "
   Water ..... 1 L.
   pH: Below 4.
   Time: 3 min.

After either of the above dips, the articles are allowed to drain for 10 sec. and are then immersed in 5% sodium hypobromite solution at room or elevated temperature.

Electrolytic Black

U. S. Pat. 2,351,639. E. W. Schweikher, assignor to E. I. duPont de Nemours & Co., June 20, 1944. In a process for the production of an electrodeposit, the step comprising electroplating a cathodic deposit of a molybdenum-oxygen compound at a current density of about from 0.1 to 10 amperes per square foot from an aqueous bath including nickel sulfate and a soluble molybdenum compound selected from the group consisting of sodium molybdate, potassium molybdate, ammonium molybdate, and molybdic oxide, the bath containing from about 0.25 to 1.5 grams per liter of a polyhydric alcohol selected from the group consisting of glycerol and diethylene glycol, and the amount of molybdenum present calculated as metal, being from 7 to 150 grams per liter and from 1 to 5 times the amount of nickel present, calculated as metal.

Example:

Boric acid	48	g./L.
Sodium molybdate	22.5	"
Molybdic oxide	15	"
Nickel sulfate	30	"
Sodium thiocyanate	3.8	"
Glycerol	0.75	"

pH: 4.0. C.D.: 1.0-10 amp./sq. ft.

Plating Apparatus

U. S. Pat. 2,355,236. R. H. Olsen, Aug. 8, 1944. An electroplating apparatus comprising a tank open at its upper end and adapted to contain an electrolyte, a rod mounted in the upper end of said tank at a point above the level of electrolyte therein, a solid cathode disposed vertically in said tank and having a hook at its upper end engaged over said rod to support the cathode in the tank in spaced relation to the bottom thereof, a tubular anode disposed vertically along said cathode and closed at its lower end, insulated fasteners supporting said anode from the cathode in spaced and substantially parallel relation thereto, perforated branch tubes carried by said anode and projecting laterally from opposite sides of the anode and the cathode and having their inner ends communicating with the anode, brackets to support articles to be plated about the branch tubes formed from strands of wire each having its intermediate portion crimped and secured firmly against the cathode and its end portions projecting from opposite sides thereof and bent to form arms extending toward the anode and then laterally therefrom over the branch tubes and terminating in hooks, and a pump having a feed pipe communicating with the tank near the bottom thereof and a discharge pipe communicating with the upper end of the tubular anode.

Repairing Vitreous Enamel

U. S. Pat. 2,355,474. S. W. Shepard and J. S. Magielnicki, assignors to American Cyanamid Co., Aug. 8, 1944. A method of repairing breaks in the vitreous lining of steel equipment lined with vitreous material, which comprises producing a clean roughened surface extending through to the metal by abrasive blasting and applying a coating of precious metal by means of a metallizing gun.

Acid Pickling Inhibitor

U. S. Pat. 2,355,599. J. F. Walker, assignor to E. I. duPont de Nemours & Co., Aug. 8, 1944. The method of removing oxidic foreign matter from the surface of a metal which comprises subjecting a metal article to the action of a non-oxidizing acid bath containing 0.1 to 2% by weight of alpha-trioxymethylene as corrosion inhibitor.

Polishing Wheel

U. S. Pat. 2,355,667. R. L. Melton and A. L. Ball, assignors to The Carborundum Co., Aug. 15, 1944. A permanently charged abrasive polishing wheel of high flexibility comprising a plurality of felted layers of textile fibrous material having a major portion of the abrasive polishing material and a non-smearing binder included internally throughout the individual fibrous layers, said abrasive-containing layers of fibrous material being adhesively united about the arbor of said wheel, said wheel containing interposed layers of spacing material between the fibrous layers of the article, said interposed layers being substantially co-extensive with the area of the wheel which has been adhesively united.

Tin Recovery

U. S. Pat. 2,355,777. T. W. Benson and B. F. Hoffman, Aug. 15, 1944. A process of recovering tin from scrap containing the same, which comprises thinly coating a caustic alkali upon such tin scrap and fusing such caustic alkali coating upon the surface of such tin scrap to convert the tin into an alkali metal stannate.

Purification of Nickel Solutions

U. S. Pat. 2,356,183. H. M. Shepard and C. A. Knierim, assignors to American Smelting & Refining Co., Aug. 22, 1944. The process of treating impure nickel sulphate solutions containing iron principally in the ferrous state to separate the iron therefrom comprising adjusting the pH value of the solution to between 3 and 4 to avoid precipitation of nickel, heating the solution to between 80 and 180° F. and oxidizing ferrous iron in the solution to ferric condition by introducing hydrogen peroxide and hydrated lime into said solution, the hydrogen peroxide being in amount sufficient to complete the oxidation of ferrous iron to ferric and the hydrated lime being in amount sufficient to maintain the said pH value between 3 and 4, and precipitating ferric hydroxide from the solution substantially free from nickel, said hydrogen peroxide and hydrated lime being introduced in the form of a slurry and containing a ratio by weight of peroxide to calcium hydroxide of approximately 1 to 1.05 respectively, calculating the peroxide as 100-volume material.

THIS IS WASHINGTON–

By George W. Grupp
METAL FINISHING's Washington Correspondent

Bognar Returns to Industry John J. Bognar has resigned as Chief of the Finishing and Treating Section, Repair Shops Branch, Service Equipment Division in the Consumers Hard Goods Bureau of the War Production Board to become a mid-west sales and service representative, with headquarters in Chicago, of the Hanson-Van Winkle-Munning Company at Matawan, N. J., manufacturers of electroplating and polishing equipment and supplies. John came to the War Production Board on June 30, 1942, at the request of Frank P. Downey, Jr., who was then Administrative Assistant to Charles Schoenlaub, Chief of the Production Requirements Plan Branch. His first job was that of an analyst in the Production Requirements Plan Branch. Three months later, September, 1942, he was promoted to analyst in the Equipment Service Division where he remained until December, 1942, when he was appointed to the position of Senior Industrial Specialist in the Electroplaters, Galvanizers, and Other Metal Coaters in the Repair Shops and General Service Section of the Service Equipment Division. In June, 1943, he was made Chief of the Finishing and Treating Section which is the primary reference for electroplating shops, galvanizing shops, and heat treating shops in dealing with the WPB. About seventeen of John's thirty-one years of life have been spent in the electroplating business. In fact he had only one employer in his life before coming to Washington, and that was the Chromium Corporation of America. He started in the inspection department of this company's Chicago plant. Later he worked in the plating, buffing, sales, purchasing, shop production, and executive departments of that company. At the time he accepted the offer to come to Washington to do his bit in the war effort he was assistant to the manager of the Chicago plant. His duties with the War Production Board will be absorbed by Dewey M. Crim, Chief of the Repair Shops Branch of the Service Equipment Division. When John was not at the office he spent most of his time with his wife, two sons and one daughter. But in spite of his devotion to his family he did manage, now and then, to get some exercise by bowling, by playing golf, and by walking around the table when he played billiards. According to reports in Washington John's legion of friends in the electroplating industry of the mid-west will be glad to see him return to Chicago—the home town of Bognar and his wife. On the other hand the host of friends he made while in Washington will miss him. Their best wishes follow him to achieve great success in his new endeavor.

Electroplating and Anodizing Equipment Defined Limitation Order L-123 as amended August 31, 1944, transfered the control of oxy-acetylene apparatus from Order L-268 to Order L-123. In amended Order L-123 the definitions of electroplating and anodizing equipment were revised to read as follows: "Electroplating equipment means any of the following equipment intended to be used in the process of depositing metal by means of a solution and an electric current (except equipment for electrolytic refining of metals): Rinse tanks, acid dip tanks, plating tanks, cleaner tanks, spray tanks, linings for tanks, anode and cathode rods, racks and other forms of holding cathodes, motor-generator sets, generators, rectifiers, panel boards, individual plating barrels, automatic or semi-automatic plating machines, full automatic plating machines, buffing lathes, degreasers, washing machines, ball anode containers, tank rheostats, cathode agitators, voltage regulators, plating baskets, filters and filter presses, dryers, tumbling barrels, and ventilating equipment. Anodizing equipment means any of the following equipment intended to be used in the electrochemical treatment of the surface of any metal to produce a corrosion-resistant film on the surface of the metal: cleaner tanks, rinse tanks, anodizing tanks, chrome dip tanks, dye tanks, linings for tanks, anode and cathode rods, racks, motor-generator sets, generators, rectifiers, tank rheostats, panel boards, automatic anodizing machines, temperature controllers and regulators, baskets, meters, control and recording instruments, voltage regulators, and ventilating equipment."

Capital Equipment Production Procedure On Unrated Orders Priorities Regulation No. 24 was amended on August 24, 1944, to enable producers of capital equipment, including machine tools, precision measuring and testing instruments, electric motors and generators and other general industrial equipment to begin production on unrated orders for such equipment without first obtaining permission from the War Production Board. Persons, however, who desire to place unrated purchase orders for the items covered by List A of Priorities Regulation No. 24 must first apply for approval from WPB by filing a letter in triplicate with the nearest WPB field office. This letter must give a description of the equipment, including the make, type, size and approximate price.

Priorities Regulation 24 Amended Twice During Past Month Priorities Regulation 24 was amended on August 24, 1944. It was again amended on September 13, 1944, to provide that producers of equipment subject to any War Production Board order on List A of the regulation, such as General Industrial Equipment Order L-123 which includes electroplating equipment, Foundry Equipment and Metal Smelting Furnaces Order E-11; Electric Motors and Generators Order L-221; Electric Motor Controllers Order L-250, and Oxy-acetylene Apparatus Order L-268 must now file each month Form WPB-3940 in accordance with the instructions on that form, showing the quantity of their rated and unrated shipments. However, if the dollar value of a producer's monthly shipments of unrated orders does not exceed 10 per cent of his total shipments, he need not file this report. But such a producer must keep a record of unrated orders placed under PR 24 so that they can be readily segregated and examined. The order states that "a person who wishes to place an unrated order in spite of the restrictions of the WPB order on List A may apply for War Production Board approval by filing a letter in triplicate with the nearest War Production Board field office with a list in triplicate attached giving a description of the equipment which he wishes to get including make, type, size, and approximate price. Approval of the War Production Board will be given on Form GA-1077 if it finds that no suitable existing equipment is available. . . .

Approval by the War Production Board under this paragraph does not give the purchase order a rating of AA-5 under Section 9[illegible] (b) of Priorities Regulation 1." In making applications under PR 24 the WPB requires that "four copies of applications under this regulation must be filed with the nearest WPB field office. You must use a single WPB-1319 for all items of equipment controlled by a single WPB order, or if the items are not controlled by a WPB order, by a single WPB division. Separate forms must be used for items controlled by separate WPB orders or by separate WPB divisions if there is no order." And the WPB also points out that "the authorization on WPB-1319 limits you to the make of equipment shown but you may purchase this from any supplier." In filling out Form WPB-1319 the applicant should state in block 6 the order controlling the equipment, such as "L-123" for electroplating equipment and "Priorities Regulation 24." It is not necessary to fill out blocks 10, 13, 14, 16, 17B and 19 of the application. And in block 20 the applicant must state the approximate dollar value (a) of equipment not covered by the application but which is needed to resume or increase civilian production, and (b) of necessary equipment the applicant can obtain without the use of preference ratings. In this block the applicant must also state why the equipment is necessary to resume or increase civilian production. Priorities Regulation 24 states in paragraph (g) that the WPB will not grant ratings for needed equipment to resume or expand civilian production if the equipment can be obtained out of existing available stocks or where unrated orders for it can be filled within a reasonable time. However, where this is not the case, and equipment takes a long time to produce, the WPB will consider applications for ratings. This paragraph should be clarified because "reasonable time" and "a long time to produce" is too broad since it means different time limits in the minds of different persons.

Civil Production Under Priorities Regulation 25 Any manufacturer of metal finishing equipment, or any other manufacturer, who has the available manpower, may produce any of the items controlled by the 86 different orders listed in Direction No. 1 to Priorities Regulation 25 such as metal office and industrial furniture and fixtures under L-13-a; vending machines under L-27; metal signs under L-29; enameled ware under L-30-b; musical instruments under L-37-a; metal household furniture under L-62; cutlery under L-140-a; flatware and hollow ware under L-140-b; and commercial cooking and food and plate warming equipment, under L-182. Applications must be made on Form WPB-4000 accompanied by Form WPB-3820 Revised. The Order states that "a manufacturer whose application is approved under this regulation will be given an authorized production schedule and assigned a CMP allotment symbol on Form CMPL-150C. When controlled materials are available, allotments may be made in limited amounts and will be 'deferred allotments' under Direction 54 to CMP Regulation No. 1." The Order also makes it clear that "preference ratings of AA-5 will be assigned but only for the production of utility items of importance in civilian requirements."

How MRO May Be Extended Any person who has been given a maintenance, repair and operating supplies symbol (MRO) and rating under CMP Regulation No. 5 may now use such rating to obtain materials to install or relocate machinery or equipment according to amended Direction 15 to the CMP Regulation No. 5 issued on August 23, 1944. Where construction is involved, WPB officials say, persons may obtain materials needed for the installation or relocation of machinery or equipment as permitted by Direction 2 to Order L-41. If construction is not necessary, materials valued up to $500 may be obtained to install any piece of machinery or equipment rated or authorized by WPB.

Partial Payments for Terminated Contracts General Regulation No. 2 was issued by the Office of Contract Settlement on September 11, 1944, which provides that contractors may obtain from 75 to 90 per cent of their costs and contract price upon termination of a war contract. In issuing this regulation Director of Contract Settlement Robert H. Hinckley said that regulation numbers one and two "make it possible for factories to begin promptly upon termination of war contracts to direct their energies to peacetime production." He also added that the Regulations make it possible to pay partial payments direct to subcontractors in exceptional cases where "unwarranted delay" might result from dealing through primary contractors. A committee of representatives of the Maritime Commission, Navy Department, Reconstruction Finance Corporation, Smaller War Plants Corporation, Treasury Department, Foreign Economic Administration, and War Department are responsible for the procedure methods on partial payments on terminated contracts.

Meetings to be Held on Contract Terminations By the time this is in print it is expected that meetings of subcontractors and small prime contractors will have been held in different parts of the United States under the joint sponsoring of the Smaller War Plants Corporation and Army and Navy procurement officers. The purpose of these meetings is to interest contractors in making preparations for contract settlements and to supply them with information on the principal elements of contract termination procedures. In other words discussion will be held on such subjects as "Explanation of the Contract Settlement Act; the subcontractor's claim; interim finance; SWPC's services on contract settlement; settlement procedure by the Army and Navy Departments; and plant clearance of excess property."

Aluminum and Zinc Uses in Making Hardware Eased Schedule 1 of Limitation Order L-236 was amended on September 12, 1944, to remove the restrictions on the use of aluminum and zinc in the manufacturing of such hardware as builders' finishing hardware, cabinet locks and padlocks and to remove the restrictions on the use of brass in the manufacturing of essential working parts of cylinder locks.

Antimony Is Again Under Import Control On August 19, 1944, the War Production Board restored governmental control over antimony by amending General Imports Order M-63.

Chromium Plated Furniture Committee Discuss Industry's Problems At the first meeting of the newly formed Chromium Plated Tubular Furniture Industry Advisory Committee on August 26, 1944, it was learned that many of the former manufacturers of chromium plated tubular furniture are still engaged in 100 per cent war production and that there are no prospects in the immediate future for them to resume their large scale production of civilian products. The members of this new advisory committee of the WPB are Burl Buckner, Noblitt-Sparks Industries, Inc., Columbus, Ind.; M. L. Brown, Daystrom Corp., Olean, N. Y.; Philip E. Ericson, Howell Co., St. Charles, Ill.; Edwin J. Perry, Lloyd Mfg. Co., Menominee, Mich.; Homer A. Simpson, American Fixture & Mfg. Co., St. Louis, Mo.; and Edward Fox, Empire Table Co., Inc., Chicago, Ill.

Copper Permitted as Under Coating for Chromium and Nickel Plating A number of amendments were made in Conservation Order M-9-c on August 31, 1944. Section (c) (3) (i) was amended to read as follows: "The use of copper products or copper base alloy products for plating any article on the combined list or for plating any parts (including

repair parts) of such an article, is prohibited unless such plating is expressly stated in the list to be permissible or such plating is an undercoating for lead, chromium or nickel. Undercoatings should, in general, be less than 0.00005 inch in thickness." The amended order points out that "gold filled and rolled gold plate" are "governed by Direction 2 to Order M-199." The list of commodities which can be made of copper has been increased. For example, the restrictions have been eased on "flashlights and lanterns powered by dry cell batteries (except when the only copper products or copper base alloy products used are for the plating of parts necessary for conducting electricity other than cases)."

Corundum Production Plans Progressing At the August 26, 1944 meeting of the Corundum Industry Advisory Committee of the WPB the members discussed plans to increase the imports of corundum from South Africa. It appears that the Foreign Economic Administration has worked out a program to obtain increased production of this commodity, therefore it is sending an engineer to South Africa to assist in carrying out its plans. Progress was reported by the Foreign Economic Administration on the construction of a plant to recover concentrates from Canadian ore tailings. And it appears that corundum mining operations will soon begin at Elk Creek, Montana.

Enamel Ware Production Restrictions Eased The manufacture of such domestic and hospital enamel ware such as colenders, baby bottle sterilizers, dish pans, infants' bath tubs, funnels, and baby chambers may now be resumed since Order L-30-b was amended on August 23, 1944. The amended order also permits the production of such hospital enamel ware as immersion arm baths, iodine cups, forcep jars, urinals, and graduates.

Glue Small Order Exemptions Increased Order M-227 (copper chemicals) was revoked on September 13, 1944, and the control of these chemicals transfered to Order M-300. At the same time Order M-300 was amended to increase the small order exemption for hide and extracted bone glue from 1,200 pounds to 10,000 pounds, and green bone glue from 6,000 pounds to 10,000 pounds. Suppliers are now required to file Form WPB-2947 for allocations of glue.

Laboratory Supply Restrictions Eased Preference Rating Order P-135 was amended on August 24, 1944, to lift the dollar quota restrictions on the purchase of chemicals for laboratory use. Persons in the business of conducting scientific or technological research are now entitled to an AA-2 rating to buy material for such work. Laboratories which hold a serial number under Preference Rating Order P-43 are assigned AA-1 preference ratings for reagent chemicals.

Metal Restrictions For Cutlery Eased General Limitation Order L-140-a was amended on August 31, 1944, to make available increased amounts of iron, steel and other metals for both light and large heavy duty hand hair clippers, copper and copper base alloy for linings and rivets of pocket knives, and aluminum for any type of cutlery.

Nitric Acid Shipments Stopped for Two Months The War Production Board revealed that ordnance plants were responsible for the stoppage in the shipments of nitric acid to industry from August 4, 1944 to October 1, 1944. This was necessary because of the urgent need for that chemical by the Army.

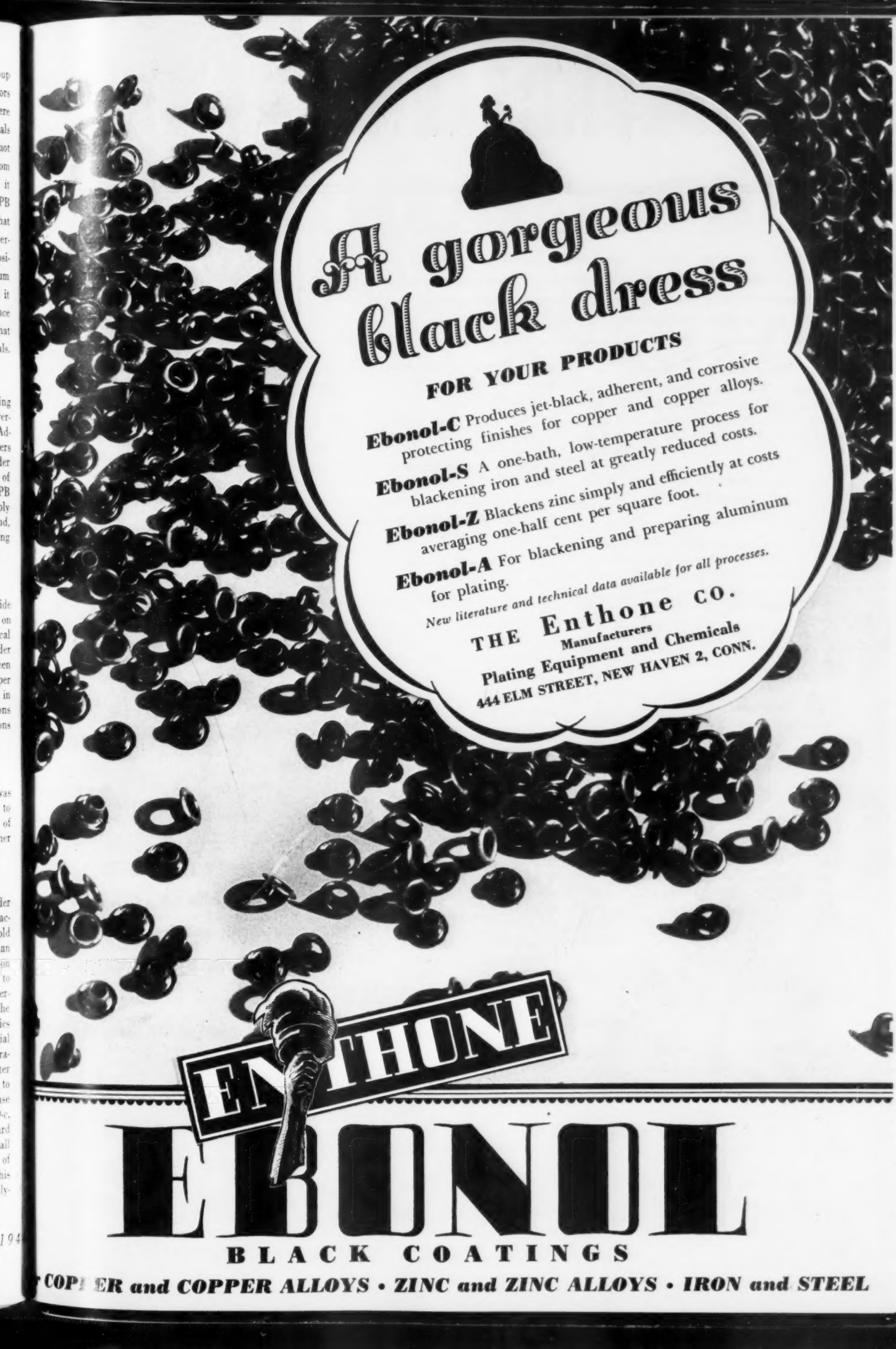
Platinum Committee Told Rhodium Electroplating Restrictions Have Not Been Eased Members of the Platinum Group Metal Producers and Distributors Industry Advisory Committee were told on August 26, 1944, by officials of the WPB that rhodium is not available for jewelry uses. From some of the remarks of some members of the Committee it was apparent that information regarding the relaxation of WPB regulations had erroneously led many jewelers to believe that the use of rhodium for electroplating jewelry would be permitted soon. The committee reviewed the supply-demand position of platinum, palladium, rhodium, ruthenium and osmium for the purpose of determining trends. From what was said it appears that the position of these metals has not changed since April, 1944. The Committee recommended to the WPB that no change be made at present in the control of these metals.

Silverware Manufacturers Recommend Revision Of Order M-199 At the September 1, 1944 meeting of the newly formed Sterling Silverware Manufacturers Industry Advisory Committee the members recommended the revision of Order M-199 to permit increased use of silver for the manufacture of sterling silverware during the fourth quarter of 1944. WPB officials, on the other hand, stressed the point that the supply of domestic silver is in extremely close balance with demand, since large quantities are used for bearings, solder, brazing alloys, insignia, and other war purposes.

Sodium Cyanide Now Under Order M-300 The allocation of sodium cyanide under Order M-366 was revoked on September 8, 1944. This chemical is now under control under Order M-300. The small order exemption for sodium cyanide under Order M-300 has been reduced from 1,000 pounds to 400 pounds per person per month because of the increased demand for this chemical in the production of aviation gasoline. Consumers' applications must be made on Form WPB-2945 and suppliers' applications must be on Form WPB-2946.

Zinc Restrictions on Plating Removed Conservation Order M-11-b was amended on September 5, 1944, to remove restrictions on the use of zinc or zinc products for protective coating or plating (other than paint), except for articles of List A.

Copper Inter-Liner Rolled Gold Plate Direction Amended Direction 2 of Conservation Order M-199 which deals with the manufacture of rolled gold plate and gold filled stock containing more than one-half of one per cent of silver by weight was amended on September 18, 1944, to provide that "any person who wants to buy copper or copper base alloys for use as inter-liner as permitted by this Direction may place an order by the use of the symbol S-4 and the standard certificate prescribed in Priorities Regulation 7. Such an order is authorized controlled material order for the purpose of all CMP Regulations." And paragraph (d) of the Direction was also amended to read "After August 7, 1944, the provisions of this Direction with respect to rolled gold plate and gold filled stock shall govern in any case where they are inconsistent with the provisions of Order M-9-c, M-9-c-2, or any other order of the War Production Board restricting the use of copper and copper base alloy. In all other respects, any more restrictive provisions of an order of the War Production Board shall prevail. No provision of this Direction shall be deemed to relieve any person from complying with any of the restrictions of Order M-199."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SHOP PROBLEMS

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Zinc Plate on Steel

Question: We wish to advise that we are flashing some steel work in cyanide zinc solution prior to silver plating, as a rust preventative; however, we find that some of the work will show small blisters a few days after setting.

We would appreciate your advising the cause of this, also, how to prevent this formation of blisters.

S. P. W.

Answer: The use of a zinc plate on steel prior to silver plating results in blistering after a few days, possibly because of a non-adherent immersion film of silver, and it is not considered good practice for corrosion prevention.

We would suggest that you use either a heavy nickel plate, or a duplex copper and nickel plate prior to silver plating.

Coloring Aluminum

Question: In the manufacture of certain parts as prime contractors for the Army Air Corps, we will be required to color "light blue" under Specification AN-WW-F-366 certain anodized aluminum 17 S-T alloy parts.

It is required that this dye be insoluble in any of the fluids used around aircraft such as gasoline, lubricating oil, hydraulic oils and water after an anodized part has been treated with the coloring agent.

It will be appreciated if you are in a position to name a supplier who might be able to furnish a dye or dip suitable for this work.

M. P. Co.

Answer: If the anodized coating is properly sealed after dyeing, there should be no leaching action, and the blue dyes usually recommended for treating anodized aluminum should be satisfactory.

For information on the dyeing of anodized aluminum, we can refer you to the March issue of *Metal Finishing*, in which you will note an article by Darrin and Tubbs on the subject in connection with the chromic acid anodizing process.

For the sulphuric acid process, we would refer you to the Aluminum Company of America, Pittsburgh, Pa.

Removing Fire Scale

Question: I am interested in jewelry and plating. Will you please tell me how to make the "fire-off" for silver and gold? I don't mean the simple "pickle" but a special solution for "fire."

P. C.

Answer: A commonly used solution for removal of fire scale from silver and gold is a mixture of one gallon of sulfuric acid and nine gallons of water operated hot.

Another commonly used solution for silver consists of two gallons of nitric acid and one gallon of water. This solution may be used at room temperature, but will operate more rapidly if heated.

Nickel Salt Paste

Question: We would appreciate having a copy of the formula of the nickel salt paste used for brushing with current.

C. C. & B. Co.

Answer: The following formula has been patented by Rapids (U. S. Pat. 2,061,591-2):

Nickel chloride	25%
Ammonium chloride	10%
Water	45%
Cornstarch	20%

Copper Plating

Question: Could you please tell me where I can find information concerning the copper plating of stainless steel? I have searched through the available literature with very little success.

R. J. T.

Answer: Three suitable procedures are available, and we list them as follows:

1. Gardam Solution:
   Single Nickel Salts ... 240 g./L.
   Sulphuric Acid ..... 50 "
   35° C., 150 A. S. F., Lead Anodes.

A thin nickel deposit is produced in a few minutes, and the articles can then be copper plated as usual.

2. Wood Solution:
   Nickel Chloride ..... 32 oz./gal.
   Hydrochloric Acid ..... 1 pt./gal.
   6 volts, room temp., Carbon or Nickel Anodes, temp. 1-2 minutes.

3. Shirley Solution: This solution differs from the first two in that there is no intermediate coating of nickel between the copper deposit and the stainless steel base. The article is treated as cathode for 1 minute at 27 A. S. F. in a 21 fl. oz./gal. solution of sulphuric acid at room temperature. Without rinsing, the article is then transferred to the following solution and plated for 15 to 20 minutes at 27 A. S. F. and 212° F. in:

   Copper Sulfate ..... 30 oz./gal.
   Sulphuric Acid ..... 35 "

The article is then rinsed and both operations are repeated until the piece is completely covered with copper.

A number of patents were issued on the subject of deposition on stainless steel, and we would suggest that you examine past issues of *Metal Finishing* for details.

Plating on Chromium

Question: We would like to plate hard nickel over a chrome plate. Have you any information on plating on chromium?

We would very much appreciate any help you can give us on this.

C. P. Co.

Answer: According to Gray and Northrup (U. S. Pat. 1,892,051) the chromium plated object is given a three-second strike at nine to ten volts in a solution containing 20 c.c. of 5% cupric chloride solution in four liters of C.P. hydrochloric acid, using copper anodes. It is claimed that technical acid is unsatisfactory.

According to Wagner (U. S. Pat. 2,118,956) the article should be made cathode at six to eighteen volts for one to five minutes in an alkaline solution, the strength of which is not important. The surface is then etched in sulfuric or hydrochloric acid until a smut forms, after which the article is rinsed and plated.

The Gardam Solution may be suitable, and involves a five to ten minute strike at 35° C. and 150 amp./sq. ft., in a solution containing 240 g./L. single nickel salts, and 50 g./L. sulfuric acid.

After treatment with one of the above, the article may be plated as usual.

A.S.T.M. Specification B-177-43T

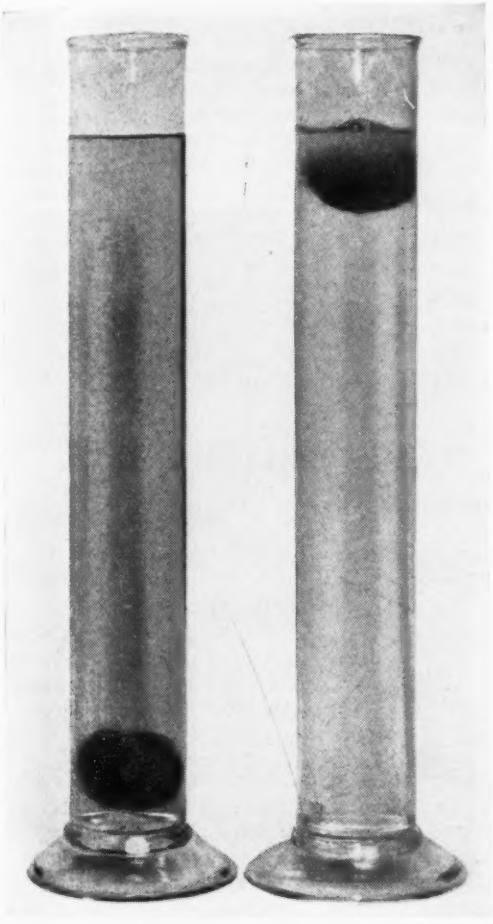
Question: Please send us your preparation of surfaces for industrial chromium plating A.S.T.M. Specification B-177-43T covering "Tentative Recommended Practice for Chromium Plating on Steel for Engineering Use."

A. & J. M. A. Mfg. Co.

Answer: We do not have any copies of the A.S.T.M. Specification B-177-43T. Copies may be obtained from the American Society for Testing Materials, 260 South Broad St., Philadelphia 2, Pa.

REMOVE SCALE AFTER HEAT TREAT

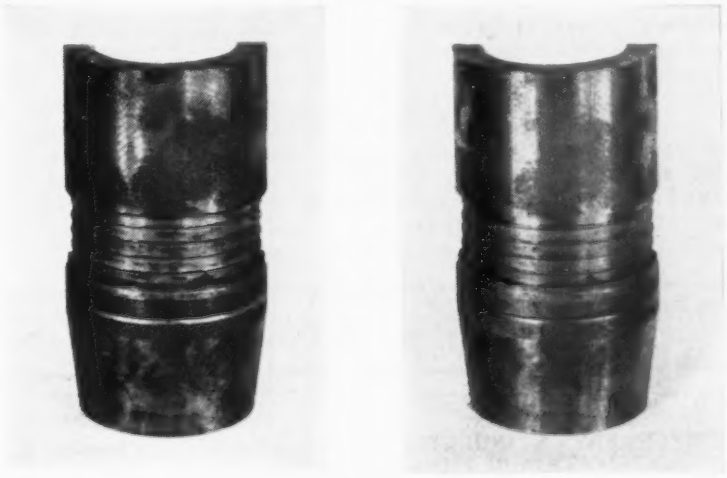
WITH DIVERSEY EVERITE



Diversey Everite is a powerful solvent specially developed to remove heat scale quickly and completely without harming the sound metal. Will not change dimensions of forgings and castings. Also removes rust from metal surfaces. Reduces hydrogen embrittlement. Economical . . . works only on oxide and other unwanted deposits . . . not on the metal. Easy to use by soak or circulating method. P.S.—Remove quenching oil with Diversey DC-22 in tank cleaning or DC-14 in power washer.

1. REDUCES HYDROGEN EMBRITTLEMENT

Here's proof—Place a small wad of steel wool in graduates filled with Diversey Everite and raw acid. Note how the steel wool is carried to the surface by bubbles of hydrogen released by the raw acid. In the Everite solution, the steel wool remains at the bottom . . . there's no evolution of hydrogen, no corrosion.



2. WILL NOT INJURE METAL SURFACE

Here's proof—Select two rusty pieces of steel. Place one in a solution of Diversey Everite and the other in raw acid. Note how Everite removes the rust quickly and completely, AND THEN STOPS while the raw acid continues to dissolve the sound metal after the rust is gone.

For Liberal Experimental Sample Write Metal Industries Dept.

THE DIVERSEY CORPORATION 53 W. Jackson Blvd. Chicago 4, Ill.

VISIT THE DIVERSEY EXHIBIT
SPACE #A-624
NATIONAL METAL EXPOSITION
Cleveland, Ohio, October 16-20

. . . HELP WANTED?
JUST CALL A

DIVERSEY D-MAN

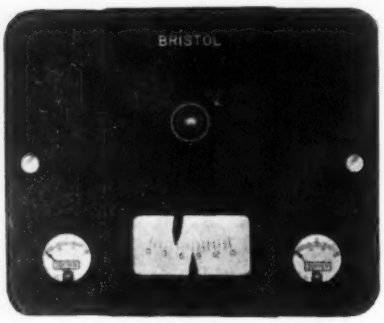
NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Air-Operated Controllers

The Bristol Company, Dept. MF, Waterbury 91, Conn., has just announced the development of a new series of indicating air-operated control instruments. The new instruments, known as the Model 93 series, are built for controlling temperature, pressure, vacuum, liquid level, and humidity.

Model 93 Controllers operate on the Free-



Vane principle of automatic control. They have a throttling range of from ½ to 15% with the adjusting mechanisms arranged so that changes in the throttling range can be made by the user without the need of tools.

Model 93 Controllers are direct set instruments that can be set to control at any value within the range of the instrument by turning the control pointer to the desired value. They are built so that they can be changed by a finger adjustment from reverse to direct action or vice versa.

Typical applications for the Model 93 Controller are as follows: the control of temperatures in bake ovens, drying ovens, cookers, retorts, plating tanks, and soft metal pots and the control of steam pressure, pressure in retorts, and back pressure in digesters.

Copper Process

A completely new alkaline copper of the Rochelle type, which will deposit copper at greatly accelerated rates in still tank, semi or automatic machines.

Super-R has all the famous Promat characteristics — ductile, buffs easily to high brilliance, and produces an extremely uniform deposit. Super-R Copper is furnished in the form of prepared concentrated Super-R Electrolyte, or your existing Rochelle type electrolyte may be converted for use. The power source is provided by a Promat Kicker which supplies alternating current for superimposition upon direct current supplied by a generator or rectifier.

Super-R is a very flexible, easily controlled high speed method of plating copper in Rochelle type baths without the usual operating difficulties inherent with conventional plating.

Further information may be obtained by writing to Promat Division, Poor & Co., Dept. MF, Cincinnati, Ohio.

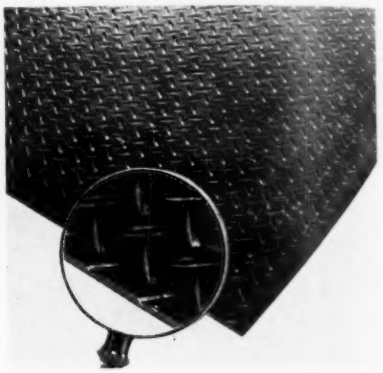
Single-Lens Goggle

Just announced by Willson Products, Inc., Dept. MF, of Reading, Pennsylvania, is the new Willson MonoGoggle designed to provide high impact strength, unobstructed vision and the highest degree of comfort. Weighing only 1¼ ounces this new streamlined goggle has a replaceable, nonshatterable crystal-clear plastic lens and can be worn comfortably over any prescription glasses.

Floor Matting

A new type of matting for use in many places where rubber matting was formerly used has just been made available by American Mat Corporation, Dept, MF, 1799 Adams Street, Toledo 2, Ohio.

This new product which is being marketed under the name of Ameritred, is a solid plastic friction type mat made by



firmly binding friction compound together by a plastic. It is ideal for use in building entrances, lavatories, shower and locker rooms, and for covering worn spots on floors.

It lies flat and affords a non-slip surface. By keeping feet off cold floors and reducing fatigue it increases efficiency and production. It promotes sanitation, good scrapeage providing easy removal of dirt from traffic. A factor in reducing breakage also is afforded. Jet black in color, it comes in 29″ x 63″ x 9/64″ easily handled and easily cleaned sheets. It does not swell as rapidly as rubber where exposed to various types of oils. This plastic friction type mat can be trimmed to fit smaller or odd shaped areas.

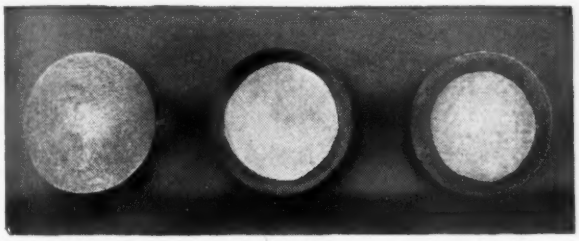
Professional Directory

After 11 months' test in sulfuric acid pickling Monel Rods show 3 to 1 strength advantage

The best measure of a tie-rod's merit is its ability to keep a pickling tank tight after a period of service.

This requires high corrosion resistance to maintain (1) the strength of the rod and (2) the structure of the threads on the end.

This illustration shows a cross-section of three metal rods... Monel, and two other metals frequently used in pickling... tested by the Research Department of a large steel mill after 11 months' service.



Monel *Metal "A"* *Metal "B"*

The rods, 1" diameter by 18" long, were bolted through a wooden rack and tested under actual plant conditions in a tank used for pickling hot-rolled sheets. The sulfuric acid content of the pickle was maintained at from 5% to 7% by weight. The operating temperature was 180° F.

After a total exposure of 331 days, or 2448 hours actual pickling time, metals "A" and "B" showed serious deterioration with only a residual core of the original metal remaining (see photos). The Monel rod had remained smooth, and was only slightly discolored. Load tests revealed that the Monel rod had over 3 to 1 strength advantage. The strength of rods "A" and "B" had been seriously impaired.

MAXIMUM LOADS SUSTAINED BY SPECIMEN TIE-RODS AT END OF TEST

Metals	*Maximum Load* (*Average of 4 or more rods*)
Monel	52,800 lbs.
Metal "A"	15,300 lbs.
Metal "B"	14,500 lbs.

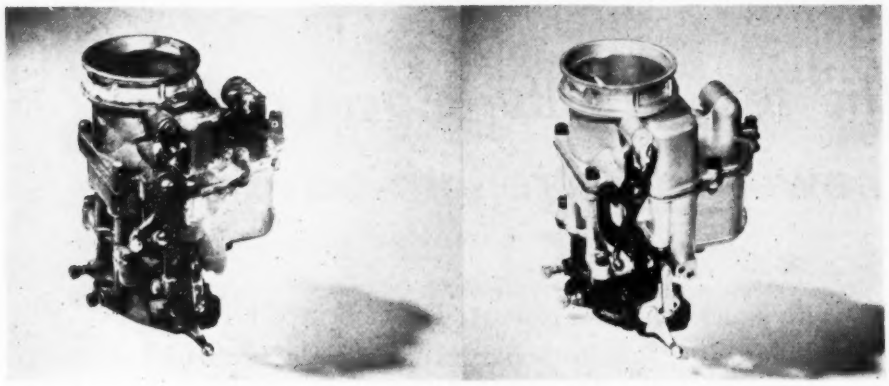
The condition of the threads was noted and measurements made. At the critical point on the threads *ahead* of the nut, rods of metals "A" and "B" suffered attack that destroyed their usefulness. The Monel rod showed no significant attack at this vital spot, thus maintaining its full usefulness.

Tough, strong and highly resistant to corrosion, Monel showed in these tests, as it has in other tests and in years of practical service, that it is uniquely fitted for long-lived pickling equipment.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street **New York 5, N. Y.**

INCO NICKEL ALLOYS

MONEL • "K" MONEL • "S" MONEL • "R" MONEL • "KR" MONEL • INCONEL • "Z" NICKEL • NICKEL
Sheet... Strip... Rod... Tubing... Wire... Castings



Carburetor, before and after Zinctone treatment is shown above. Zinctone removes soil, stains, corrosion, and protects the metal against further corrosive attack. Note the pleasing luster of the Zinctoned carburetor, at right. Zinctone does not change the color of the metal, but brings out a lustrous, silvery bloom.

Zinctone

Zinctone, a quick chemical process for brightening and improving the corrosion resistance of zinc alloy die castings is a new development announced by Turco Products, Inc., Dept. MF, of Los Angeles and Chicago. The Zinctone process seals the outer "skin" of the casting, helping to protect it from mechanical penetration and corrosive attack. At the same time Zinctone produces a smooth bright surface which compares favorably with the finish produced by mechanical polishing or buffing. The Zinctone process does not change the color of the metal, but brings out a lustrous silvery bloom which greatly enhances the appearance of the casting.

This process may be used as a treatment for new castings, and as a method of reclamation for used zinc alloy die casts. The process removes stains and corrosion, seals, passivates, brightens. So thorough is the process that many castings which would have otherwise been discarded may be restored for months of additional service. Carburetors and fuel pumps are typical zinc alloy die casts which may be reclaimed in this manner.

Adaptable to both small shop and mass production set-ups, the procedure makes use of simple, easily available immersion equipment. Already in extensive operation at many Army overhaul depots, the Zinctone process may be handled entirely by unskilled personnel.

Parts Cleaning Systems

A new parts cleaning system, combining the utility of two washers into one self-contained portable unit, has been announced by the Gray-Mills Co. of Evanston. The system includes a portable cleaner with a unique "Swisher" feature and cold-cleaning Flo-Bac Solvent.

Large parts, requiring individual handling, are cleaned of grease and grime by a strong stream of solvent pumped from the tank below. The smaller parts may be washed in quantity by merely pouring them into a basket and immersing in solvent. A two-section shelf may be removed, giving access to the dipping tank below. The dipping basket rests on a simple, hand-operated "Swisher" device, which speeds the cleaning operation by providing a convenient method for agitating fluid.

Parts such as castings, gears, bearings, carburetors, air cleaners, machine products and tools may be washed quickly in the Gray-Mills Cleaners. The cleaning unit is fully portable, equipped with a built-in gear-type pump. A safety-cover eliminates fire hazards. The Flo-Bac Solvent is used cold, and degreases parts without pitting and corroding. It is used over and over again and continually filtered.

Two models are available, P70 described above, and a smaller model, the P60. A four-page folder giving complete information will be sent on request. Gray-Mills Co., Dept. MF, 1948 Ridge Ave., Evanston, Ill.

Hole Cutter

A new all-purpose adjustable hole-cutting tool is announced by Bruno Tools of Beverly Hills, California. This unique new tool, manufactured by specialists in the field of fine cutting tools, quickly cuts smooth holes in wood, steel, brass, hard rubber, aluminum, fibre, plastics and problem materials which might necessitate use of torches or other expensive equipment. Two sizes are available, each equipped with an easily re-sharpened high speed steel blade. One model cuts holes to any diameter from 5/8 inch to 1¼ inch through ⅛ inch thickness. The other model covers all expansions from 1 to 2½ inches through thicknesses up to 3/8 inch. The tools are designed to operate in light drill presses, portable drills, or breast drills and are also available with square shanks for use in hand braces.

The adjustable hole cutter is designed on a new principle which permits easy, yet extremely accurate adjustment. It consists of a drill which starts the hole and also serves as a pilot for the tool, a hardened body with a milled slot into which is set a specially-ground high speed steel tool bit, and a hardened and ground shank. Adjustment is obtained by loosening the hexagon bolt which holds a firm locking grip, and sliding the blade to the correct distance from the pilot.

Thickness capacity of the tool varies with the type of material being worked. Metals up to 3/8 inch thickness are cut quickly and smoothly. Wood, plastics, and compressed materials may be cut to much greater thicknesses, in most instances the thickness capacity being unlimited.

For prices and complete specifications write to Bruno Tools, Dept. MF, Beverly Hills, California.

Fire Extinguisher

Randolph Laboratories, Inc., Chicago, Ill. has produced a 25 pound wheel-type carbon dioxide fire extinguisher that is moved and operated with uninterrupted, single-sweep action.

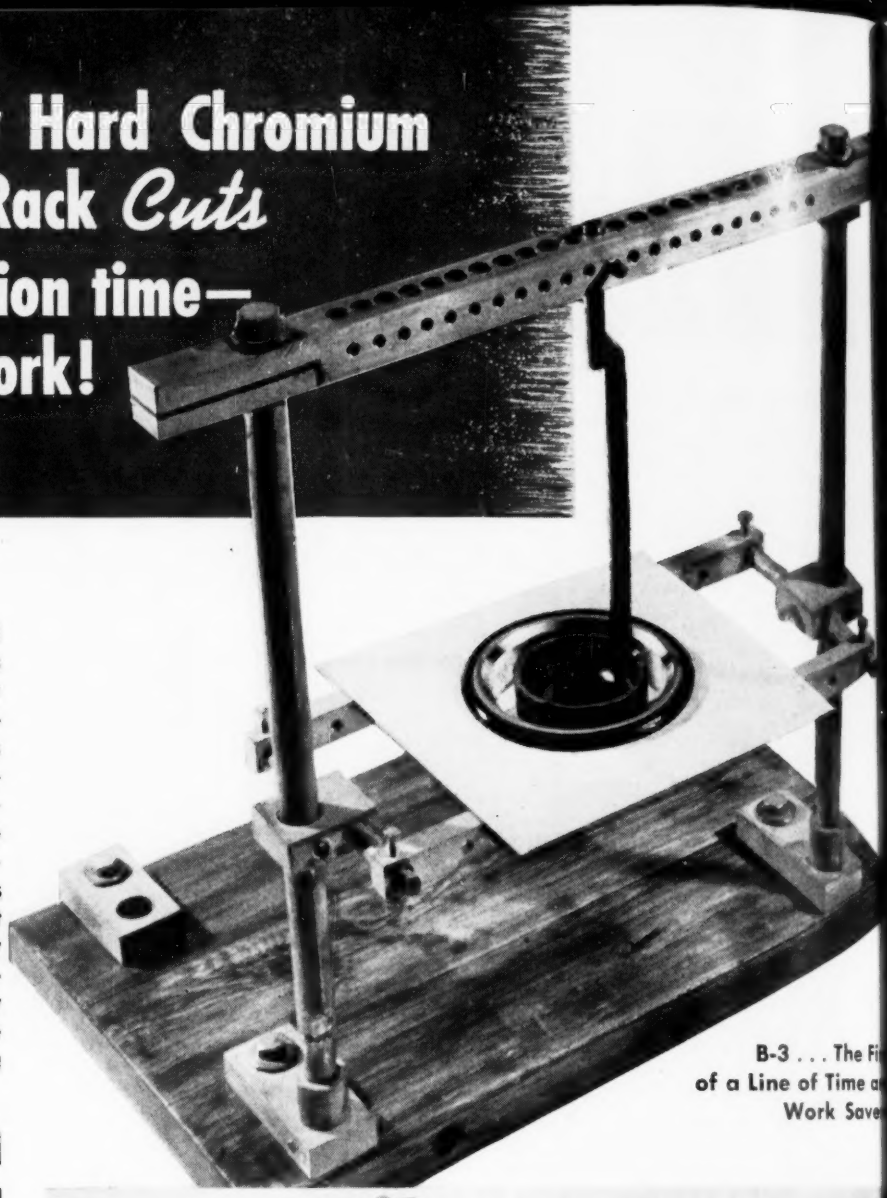
The Randolph "25" features an exclusive palm-trigger valve, mounted conveniently on the extinguisher steel handle. By grasping the handle, the operator can move the unit and press the release button with one hand discharging a penetrating, icy blanket of carbon dioxide in a large, sweeping arc—10 to 20 feet.

Release of pressure on the palm-trigger automatically stops the flow of carbon dioxide gas, eliminates twisting of valves and retains the remainder of the charge for repeated attacks. This simplified operation saves precious seconds and greatly reduces the chances of "operator's panic."

The long range 5¾ foot horn-and-hose connection directs an accurate, full charge into the base of the flames and keeps the operator at a safe distance from the heat of the fire. Mounted on hard-rubber wheels, the unit is self-balanced—standing or in operation.

This exclusive design makes Randolph "25" one of the fastest-firing 25 lb. extinguishers manufactured. This unit is especially recommended for protection against gasoline, oil, paint, grease, machine, electric, and surface fires in shops, shipyards, refineries, garages, airports. Additional information on carbon dioxide fire-fighting methods may be obtained from the manufacturer, Randolph Laboratories, Dept. MF, 8 East Kinzie St., Chicago, Ill.

B-3 this new Hard Chromium Plating Rack *Cuts* preparation time—saves work!



B-3 . . . The Fi
of a Line of Time a
Work Save

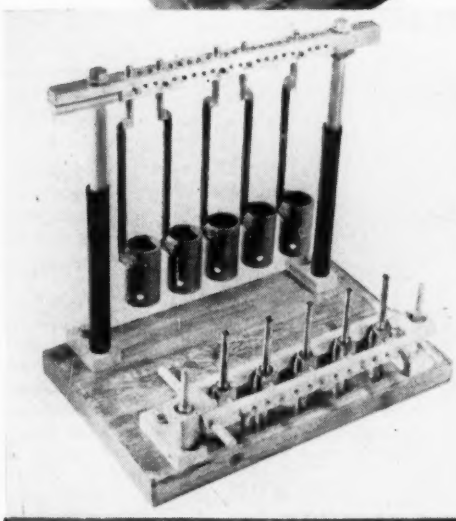
Developed within the industry—a Hard Chromium Plating Rack that handles like an "erector set" . . . from a few simple adjustable props come a number of varied, efficient arrangements that do away with the need for "acrobatic" contrivances, and the time consumed in sweating them out. As to process costs, the B-3, through time-saving, is dollar-saving! The B-3 is new, but plant-proven! It is the first of a complete line of revolutionary hard plating equipment to be produced by a company whose twenty years of experience in this field can be depended upon to make hard plating *softer* for all.

ADJUSTABLE. Handles *Any* Small Size Piece...and *All* Shapes!

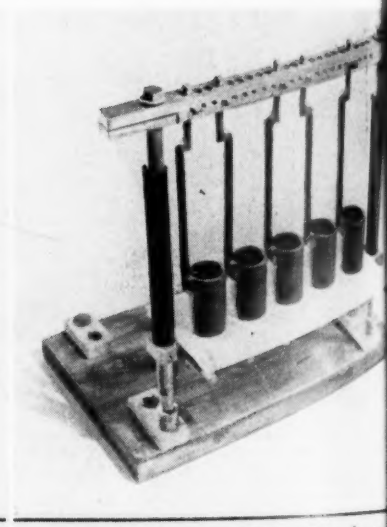
Illustration above shows a medium-size set-up for plating an inside diameter. The illustrations to the right progress a multiple set-up for external plating. Should a large quantity of parts require hard chromium plating, reloading is accomplished by loosening the thumb screws and withdrawing the pieces from the base. The rack is then ready to receive the reload. In many cases, and such as this, it is not necessary to remove the anode or change its setting. The work is at all times held rigidly in the rack.

The excellent certainty of contact, together with the rigidity of the work-holding and anode-holding devices practically eliminate any possible cause for defective plating such as usually occurs through shifting and re-setting. B-3 not only shortens set-up time, but it also secures a uniform deposit which, in production runs, is of great value. The set-up, as indicated, or any of other various combinations, can be made by anyone with a slight mechanical knowledge. As a time saver and work saver, B-3 has no peer.

The B-3, moderately priced, is sold outright—No royalties! Complete details upon request. Prompt inquiries urged.



A B-3 multiple set-up; the work rigidly held by the rack bottom. Anodes, and securely fastened rack legs held upright, are ready for lowering over the work.



Here the rack legs are fastened to the ra bottom; anodes are in place over the wor The unit is now ready to be put through th regular plating process.

INDUSTRIAL HARD CHROMIUM PLATING EQUIPMENT CORPORATION
13 ROME STREET, NEWARK 5, N. J.

Business Items

R. J. Green

J. J. Siefen Company announces the appointment of the *R. J. Green Co.* of Waterbury, Conn., headed by *R. J. (Bob) Green*, as eastern distributor and consultant for their products. These products include a complete line of polishing and plating supplies and equipment.

The years that Mr. Green has spent in the polishing and plating industry will be of considerable help to those factories looking for new and better methods of finishing.

In keeping with their current program of enlargement and expansion to meet present and post war requirements *Mr. George L. Nankervis* announces the recent addition to

H. M. Cherry

the personnel of the *George L. Nankervis Company* of:

H. M. Cherry as General Manager. Mr. Cherry, known throughout the Metal Finishing trade as one of the foremost authorities on equipment and practice in the industry, has a background of over twenty-three years practical experience in all phases of the work. "Mose" Cherry is a graduate Chemical Engineer, U of M '18. He was first connected with the Metallurgical Division of the General Motors Laboratory and later with the Harrison Radiator Division of that corporation where he was superintendent of all polishing, plating and metallurgical work. For fourteen years he was Detroit District Manager of the Hanson-Van Winkle-Munning Company, and for the past five years has been occupied as Equipment Engineer with the A. T. Wagner Company of Detroit.

E. F. Houghton & Co. announces that its office for the metropolitan New York area, formerly located at 421 Seventh Avenue, New York, N. Y., has been combined with its office and warehouse at 135 Hoboken Avenue, Jersey City 2, New Jersey.

The Foxboro Company, makers of industrial instruments for measurement and control, announces that *Mr. Walter H. Ridley* has joined the sales promotion department, at the head office, Foxboro, Mass. Since graduating from M. I. T. in 1928, Mr. Ridley has been engaged as designer and sales engineer for two well-known firms manufacturing textile mill machinery.

S. C. Johnson & Son, Inc., Racine, Wis., has just announced the following appointments in their Sales and Research Divisions, in preparation for an expanded post-war operation.

Ray W. Carlson, formerly Central Divisional Manager for the company, has been made sales manager with headquarters at Racine. Mr. Carlson, under the direction of the Sales Vice-President, *P. M. Petersen*, will supervise the operation of the field sales organization.

John H. Hurley, formerly manager of the

Now—Air Operated Collet Chuck Relieves Second Operation Work on Screw Machines

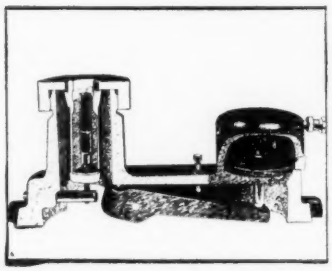
Work formerly requiring automatic or hand screw machines can now be done at much less cost through the combination of this new air chuck and any drill press. The Redmer Air Chuck is a collet air chuck using standard Brown & Sharpe type screw machine collets. The collet remains stationary, the opening and closing controlled by a sleeve action.

By using a collet as the chucking means, slight variations in the diameter of the work as frequently experienced with automatic and hand screw machine products can be permitted without sacrificing accuracy or concentricity. Thus accomplishing an important saving in time and cost.

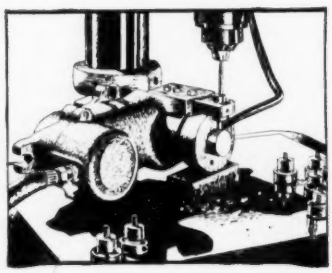
The air chuck is an ideal tool for holding parts for drilling, milling, slotting, burring, chamfering, boring, counterboring, tapping, threading, reaming and other work where the machine operation should be concentric with the chucking surface. It is adaptable to many different jobs merely by changing collet and stop. This results in saving of valuable production metals and materials. The chuck will take any type work whether round, hex, square or rectangular, and permits full efficiency of the operator, as it is operated by a foot operated valve thus leaving hands free to load and unload—reducing fatigue and cutting unproductive time to a minimum.

Wrigley's Spearmint Gum, too, is a help on the job. For chewing gum helps relieve dry throat, and helps ease fatigue brought on by the strain of work. And at the same time you are chewing and getting the benefits of swell tasting Wrigley's Spearmint, both hands are free and you need not take a "time out." The Army and Navy have recognized these benefits and are now shipping overseas *only*, all of the limited production of Wrigley's Spearmint. When Wrigley's Spearmint can again be produced in sufficient quantity for all, the valuable benefits of Wrigley's Spearmint Gum now being proven on the battlefield will apply to industry here at home.

You can get complete information from Redmer Air Devices Corp., 601 West Washington Blvd., Chicago 6, Ill.



An air operated collet holding fixture for precision chucking or machine tools



Chuck can be mounted on angle for angle milling job

Y-151

Maintenance Paint Division, has been made manager of the Product Finishes Department. Mr. Hurley will direct merchandising activities on behalf of Industrial Waxes, Wax-O-Namel product finishes, water repellents for the textile industry, and protective coatings for farm perishables.

James W. Barrett, Jr., formerly in charge of Large Consumer Wax Division, has been appointed manager of the Maintenance Products Department. Mr. Barrett will direct merchandising activities covering maintenance waxes and Wax-Fortified Paints for industrials and institutions, and water repellents for laundries and dry cleaners.

Walter A. Bridgeman has been made manager of Field Research in the Research and Development Division. Mr. Bridgeman will direct all activities in connection with field research on new and established products.

Harvey W. Blankenship, formerly advertising manager for Graver Tank & Mfg. Co., Inc., Chicago, has been appointed Industrial Sales Promotion Manager. Mr. Blankenship will devote his efforts to the advertising and promotion of all products going into the industrial and institutional fields.

Littleton C. Barkley, manager of the New York office of *The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc.,* has been appointed sales manager of the Manhattan Mechanical Rubber Goods Sales Department. Mr. Barkley's appointment was announced by *Harry E. Smith,* general manager of The Manhattan Rubber Mfg. Division. For the present his office will be located at 120 Broadway, New York City.

The Diversey Corporation announces the appointment of *J. Dan Malone* as sales manager for their metal industries department. Mr. Malone was formerly director of priorities at the Wyman-Gordon Company of

J. Dan Malone

Chicago, and prior to that, served as production analyst for the War Production Board. For fourteen years before the war, he was associated with industrial firms in the metal working field.

Carl E. Richards, formerly advertising manager of Vestal Chemical Laboratories

Carl E. Richards

(St. Louis), has been appointed advertising manager of *The Diversey Corporation,* Chicago, specialists in metal cleaning and metal working.

Mr. Richards will direct the advertising and promotion of the many Diversey products that are furnished to metal industries.

Dr. A. Kenneth Graham

Dr. C. A. Crowley

Dr. A. Kenneth Graham and *Dr. C. A. Crowley* have announced the formation of the firm of *Graham, Crowley and Associates, Inc.*, as consulting electrochemists and engineers. This new organization is a consolidation of the professional practices of Technical Service Bureau, Inc. of Chicago, Ill., and of A. Kenneth Graham and Associates of Jenkintown, Pa.

The new organization has offices, libraries and laboratories at 407 South Dearborn St., Chicago, Ill., and at 473 York Road, Jenkintown, Pa. (Philadelphia area).

Dr. Crowley and Dr. Graham have been well known for their activities in the electrochemical industries as consultants during the past ten years. The firm has associated with it a group of competent engineers and chemists. They will devote their efforts to the electroplating, electrometallurgical, electroorganic, industrial electronic, paper and photo chemical fields. They are prepared to handle a large variety of problems involving special equipment design, reconversion for post-war operation, plating plant layout and design, the engineering of processes to meet specifications, the establishment of quality control procedures and research and development in the above fields.

Green Electric announces that *Crown Rheostat & Supply Company*, 1910 Maypole Ave., Chicago 12, Ill., are now the exclusive distributors for all types of Green rectifiers in the States of Illinois and Wisconsin. Crown Rheostat & Supply Co. will also handle Green rectifiers in several of the adjacent states.

H. L. Benner has been appointed Detroit technical representative of the *Electroplating Division of E. I. du Pont de Nemours & Co.*, effective September 5.

Mr. Benner formerly was in charge of electroplating service and development at the Niagara Falls, N. Y., laboratory of the Du Pont Company. With headquarters at 1530 East Hancock Ave., Detroit, he will cover all of Michigan, except the Upper Peninsula, reporting to the Chicago office of Du Pont's Electrochemicals Department.

The Optimus Equipment Company has been organized at Matawan, N. J., to design and manufacture a line of equipment for metal washing, rinsing, pickling, tumbling and drying operations. While rendering an engineering service in connection with the building of specific types of equipment for special sequences of operations, the company will also introduce a number of standard models for general metal washing use in production, maintenance and repair work. The Optimus Equipment Company will function in close affiliation with the *Hanson-Van Winkle-Munning Co.*, also of Matawan, N. J.

Associations and Societies

American Electroplaters' Society

Newark Branch

The *Newark Branch* of the *A. E. S.* wishes to announce that the first open educational meeting will be held at the Robert Treat Hotel in Newark, New Jersey, on Friday, October 20, at 8 P. M.

Encouraged by the success of similar meetings in the past which were sponsored by Newark Branch, the educational committee, under the chairmanship of *Mr. Edward Washburn*, is endeavoring to furnish valuable and interesting information to the members and friends of the A. E. S. with a view of continuing the successful trend of the electroplating industry.

Well qualified speakers will present the following timely and highly educational subjects:

Frank K. Savage—C. J. Conn, Ltd. Subject: *A Preliminary Study of Electro Mechanics by Color Photography.*

William F. Phillips—Gener Motors, Inc Subject: *Future Electroplatin and Plastic*

B. G. Daw—LaSalco, Inc. Subject: *Auto matic Plating Machinery.*

H. E. Head—Briggs Manufacturing Co Subject: *Production Anodizing.*

It is our earnest desire to continue to promote the welfare of an industry which has proven its true value during these trou bled times. Bearing in mind this thought, Newark Branch cordially extends an invita tion to those engaged and interested in the science of electroplating to attend this meeting.

Newark Branch of the A. E. S. is proud to announce that on or about October 20 the 1944-45 Year Book will be ready for distribution.

This little handbook has rapidly gained in popularity among the men in the electro plating industry in the past several years. Last year the demand from various parts of the country exceeded the supply on hand.

The material contained in the year book is practical, and useful data supplied by various members of the Newark Branch who unselfishly make these contributions for the purpose of furthering the advancement of the science of electroplating.

The members of Newark Branch realize that this booklet can be improved upon in many ways. It is for this reason that we hope you will accept the 1944-45 year book with the spirit in which it is given.

We invite your honest criticism and assure you that anyone willing to contribute any useful material which we may have over looked can do so by contacting *Edward B. Washburn*, 218 Riverview Avenue, North Arlington, New Jersey.

Toronto Branch

The first meeting of the 1944-45 season was held in the Clubroom of the Royal York Hotel, Friday evening, September 8th, with a good attendance. Suggestions relative to various proposed activities for the winter were discussed, the most popular being a euchre party, bowling and dancing. The idea of holding an afternoon educational session followed by a supper and a dance failed to arouse much interest, possibly due to present difficulty in getting suitable ac commodation and the fact that most mem bers are very busy. However, this and other suggestions will be given careful considera tion by the Executive Committee. One new member was elected. Speakers for the sea sons' meetings are now being selected and the prospects for very enjoyable and instruc tive meetings are good.

The feature of the evening was the dele gates' report of the Cleveland Conference in June. This consisted of a 6,000-word detailed account of every paper, exhibit, and recrea tional event, and was enthusiastically received by those present.

Some members reported completion of war orders by their firms and the return to production of peace-time products, but many are still working seven days a week on munitions.

Angeles Branch

Los Angeles Branch, A. E. S., opened its fall series of monthly business and educational meetings with a well-attended session in the Hotel Rosslyn on the night of Sept. 11.

In recognition of the growing interest which plastic tank linings, plastic rack coverings and the like have evoked among members of the Southern California plating industry, Librarian *Earl Coffin* provided a speaker on the timely subject of plastic coatings.

Treating this subject in a brief talk and lengthy open-forum discussion period was *E. D. DeHaas*, general manager, Plastic Coating Co. of Los Angeles. The speaker first presented an outline of the history of plastics and the development of plastic formulae for use in the plating industry, but reserved the major part of his allotted time to answering questions posed by the members. In his preamble he explained various types of plastic compounds and defined the relation between synthetic rubber and plastic, the difference between thermo-plastic (Plexiglass, etc.) and therma-setting plastic (Bakelite); and described the method of extruding and forming the heated malleable plastic resin through dies into desired shapes.

Concerning tank linings in general, Mr. DeHaas stated that plastics, as a whole, have excellent dialectic strength and have demonstrated their effectiveness as linings for plating tanks and wrappings for racks.

A business meeting, with President *Joseph Sunderhaus* in the chair, was held following the close of the educational session.

The Semi-Centennial of the United States-Canadian Electrochemical Industry

Electrochemists will hold their 86th Convention at Niagara-Buffalo (October 12, 13, and 14, 1944) in recognition of the 50th anniversary of the North American Electrochemical Industry. Many products, commercially new, or non-existent 50 years ago, such as carborundum, chlorine, aluminum, phosphorus, Acheson graphite, artificial emery, and numerous high-melting ferro-alloys were first produced on a large scale with the aid of Niagara's bountiful hydro-electric power. These and other electrochemical products are of prime importance in the present conquest of Japan and Germany. Without them modern warfare would be impossible—no ships, no planes, no jeeps, no tanks.

The Convention Program includes a session on "*Caustic and Chlorine*," one on "*Electric Induction Heating*," one on "*Dry Batteries*," and one on "*Electroplating*." It is most gratifying to record the success of the dry battery manufacturers in overcoming all obstacles due to lack of battery-making materials formerly imported from Africa and elsewhere.

A gala event of the Convention will be the bestowal of the *Acheson Gold Medal* and *One Thousand Dollar Prize* on *Dr. William Blum* of the National Bureau of Standards in recognition of his outstanding services in the standardization of the electroplating art. *Sidney D. Kirkpatrick*, editor of "*Chemical & Metallurgical Engineering*," and president of the *Electrochemical Society*, will make the formal presentation.

News from California
By FRED A. HERR

Ernest Lamoureux, chairman of the Board of Managers, *Los Angeles A. E. S.*, has announced continuance for the 1944-45 fiscal year of the *Lamoureux Award* which he inaugurated in 1942. The trophy is awarded to the branch member who presents a paper at a branch meeting which the judges select as the best of the year. *Earl Coffin*, *Don Bedwell*, *M. D. Rynkofs* and *C. E. Thornton* will again serve as judges, with Mr. Lamoureux as an ex-officio member.

In announcing the continuance of the contest for another year, Mr. Lamoureux stated:

"In making this award possible the purpose is to encourage the presentation of papers before the branch, and in addition, I am actuated by a desire to contribute something in return for my elevation to Honorary Membership in the Supreme Society. There are many problems yet unsolved in the field of electrodeposition of metals, in anodizing and many other finishes developed in the war effort, as well as other processes to supplant metal plating.

"All those who may participate in their effort to win this award may choose their own subjects and are at liberty to cover any phase of the industry. All papers should be presented in clear, concise form, and will be judged primarily from the standpoint of new ideas brought out and any other features of value to the membership and our Society as a whole."

A. R. Elchlepp, formerly associated with *St. Louis Silver Works* and still a member of *St. Louis Branch* of the *A. E. S.*, has formed the *Bronze Fabricating Co.* in Hollywood and proposes to engage in the design and fabrication of bronze specialty articles of various kinds as soon as the war makes possible a release of materials in sufficient quantities to warrant going ahead. Meanwhile, Mr. Elchlepp is serving as a tool designer for *Hartman Tool Co.*, Glendale, Calif., makers of precision machined products.

Manufacturers' Literature

Plastic Coatings

Just off the press is a new catalog on *Amercoat Plastic Coatings*, prepared by the manufacturer, *American Pipe and Construction Co.* of Los Angeles. The attractive 16 fact-filled pages illustrate and describe the many proven uses of Amercoat in a wide range of industries, including a comprehensive list of organic and inorganic materials, foods and beverages and actual equipment and structures that are now being protected against corrosion or contamination. Copies may be secured by writing Amercoat Division, American Pipe and Construction Co., Dept. MF, P. O. Box 3428, Terminal Annex, Los Angeles 54, Calif.

Industrial Rubber Products

Produced especially for designers of industrial equipment as well as consumer products, *The B. F. Goodrich Company*, Dept. MF, Akron, Ohio, has just issued a general booklet on its industrial rubber products, which can now be obtained upon request.

Included in the booklet are discussions of the company's line of Vibro-Insulators, devices of rubber and metal which reduce vibration, molded, extruded, lathe cut and sponge rubber products, rubber lined tanks and valves, products made with Koroseal, the company's flexible material created from plasticized polyvinyl chloride, V-belts and cements.

War Supplement of Rotary Files

The importance and extensive use of rotary files for industrial purposes in connection with the war program is strikingly evidenced by the *Grobet File Company of America's* newly published *"Rotary Files War Supplement."* This attractive six-page 8½x11 folder with a four-page insert illustrates, describes and prices over 72 rotary files of various shapes, both hand cut and ground from the solid, while the insert appendix shows profile drawings of the different styles.

This Grobet Supplement (to their regular rotary file catalog) shows the files which are permitted to be manufactured as regular items, as per WPB Limitation Order L-216, Schedule IV, June 3, 1943, amended January 4, 1944. This limitation order permits the manufacture of other shapes and sizes of rotary files to the extent of 25% of the company's monthly production.

The supplement lists the different sizes in which each style may be had, giving the diameter and length of cut of each. Many of the files are offered with a choice of cut; that is, Double Extra Coarse, Extra Coarse, Coarse, Medium, Fine, and Smooth. Complete sets of diesinkers' rotary files are included in the supplement.

Hand cut Rotary files are recommended for filing steel and hard metals; ground from the solid Rotary files are recommended for

filing aluminum, magnesium, and soft metal.

Copies of this helpful folder will be sent on request to Grobet File Company of America, Dept. MF, 421 Canal Street, New York 13, N. Y.

Scale Catalog

A new, complete and factual catalog of *Kron* Scales made by *Yale* has just been prepared for the use of buyers of precision industrial equipment who are interested in investigating the benefits and savings of scales used as an integral part of a materials handling program.

Now ready for distribution, this catalog presents the full story of the entire Kron Scale line from dormant and portable platform types of special counting, batching, tensile strength and dynamometer models. Fully illustrated with complete specifications and dimensions of every standard Kron Scale, it is a valuable reference book for every business.

In promoting a better understanding of the wide range of applications and the savings in production costs which follow when springless industrial dial scales are used, the *Yale & Towne Manufacturing Company*, makers of Kron Scales, will be glad to send this catalog to any executive interested. Address your request to the Yale & Towne Manufacturing Company, Dept. MF, Philadelphia Division, 4530 Tacony Street, Philadelphia 24, Pa., and ask for catalog *R-44* which will be mailed to you at no obligation.

THICKNESS MEASUREMENTS

(*Concluded from page 609*)

basis metals cause errors. Alloy steel basis metals having unusual magnetic properties require special calibration, as do bright nickel deposits from different types of baths. Measurements can be made on concave and convex surfaces providing the radius is not too small. Because of the rapidity with which measurements may be made, this instrument has come into wide use as an inspection tool, and is designated in some specifications. It is said to be accurate to plus or minus 10% on coatings 0.0002" thick and over.

Another type of instrument represented by the G. E. Coating Thickness Gage (Fig. 11) is based on a reactance-type bridge circuit which is balanced with a bare steel plate as a part of the magnetic circuit of one of the reactances. When a film of non-magnetic material is interposed between this reactance and the steel plate, the circuit is thrown off balance in proportion to the thickness of the non-magnetic film, and the degree of off-balance is read on an electric meter which may be calibrated to read thickness directly in decimals of an inch. Accuracy within 2% is claimed for this instrument on coatings over 0.005" thick.

Fig. 11. The G. E. Coating Thickness Gage.

Electrolytic Tests

Electrolytic methods developed to measure coating thickness are dependent on anodic solution of the coatings at 100% efficiency and accurate measurement of the time and current required. Because of its nature, this test must be applied to coatings of known thickness uniformity, or to very small areas. It is not widely used, but good results have been reported.

Salt Spray

A detailed discussion on this controversial subject is not possible here. Suffice it to say that many specifications for cadmium and zinc make it clear that while thickness tests may be supplemented by salt spray tests, the latter should not be used as an only basis for acceptance. Large variations in salt spray results on apparently identical coatings have been traced to variations in the operation of the test itself. A concerted effort is at present being made to further standardize the conditions of this test.

In conclusion, four points should be emphasized in plating to specification:

1. The specification should be thoroughly understood and it should be determined whether or not the individual job is an exception.
2. Experiments should be conducted when possible to find the most practical and economical way to meet the requirements.
3. A method should be used for measuring thickness which will satisfy the terms of the specification.
4. Thicknesses should be measured frequently in order to assure uniform consistent quality of production. Efficiency of the solution may vary without being observed. Other variables may creep in. Unless regular frequent thickness measurements are made, one cannot be sure of uniformly consistent quality.

OCTOBER, 1944

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SECTION OF METAL FINISHING

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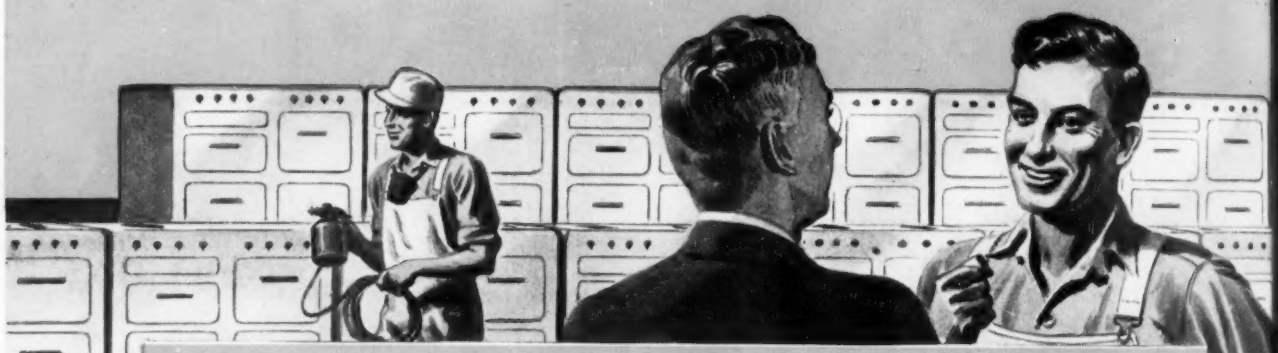

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ORGANIC FINISHING

SECTION OF METAL FINISHING

OCTOBER, 1944

CONTENTS

Cover Photograph

Checking finishes for resistance to humidity. *Photograph courtesy Servel, Inc., Evansville, Ind.*

FLOW COATING

Every now and then an interest is shown in applying finishing materials by the method known variously as flow coating, the floco process, and other names. At the moment this method is receiving attention from post-war planners investigating finishing processes for the large variety and number of products which will be manufactured to supply the tremendous war-created demands.

In its simplest form flow coating may be practiced with nothing more than an open container of finishing material and a small cup or can. The piece to be finished is suspended over the container and, using the cup the material is poured over the piece. The excess material drains back into the container to be used on the next piece.

The method can be refined to a considerable extent, depending on how much equipment is justified by the volume of work to be finished. In some instances a specially built drain pan having a connected reservoir is used. Finishing material from the reservoir is pumped through a hose to a gun or nozzle which delivers a solid stream. The stream of material is played over the piece being finished, the excess material being caught by the drain pan and collected in the reservoir for re-use. Conveyors may be used and the guns operated either manually or automatically.

Flow coating is somewhat similar to both spraying and dipping. Like any other method of applying finishing materials, it has its uses and limitations. A gun is employed, but unlike conventional spraying, the material is not atomized. None of the usual equipment necessary to regular spraying — spray booths as such, air compressors, etc. — are needed. There is no overspray and parts may be finished on one side only if so desired, as compared with dipping which finishes all areas. Flow coating, in fact, has been termed one-side dipping.

Results are similar to those obtained with dipping. It is sometimes difficult to flow coat objects having holes, pockets and contours which tend to catch and hold the material. Drips and fatty edges are also problems. On the other hand, the volume of material required to operate a flow coating unit is less than that required for dipping, especially if the pieces are large. For example, a two or three thousand gallon dip tank might be needed for a particular object, whereas a fifty gallon flow coat reservoir would be sufficient.

Flow coating has its place among the various methods of finishing. Whether or not it is used depends on the size and shape of the piece to be finished, the type of finish desired, the economics of the system as affected by equipment necessary, material utilization and similar factors.

L. H. LANGDON, *Publisher* • WILLOUGHBY G. SHEANE, *Associate Editor* • T. A. TRUMBOUR, *Business Manager*

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NEWS FROM WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Aluminum Pigments Can be Made According to RP #1 Supplementary Order M-1-g was amended on September 11, 1944 to provide that any person other than a producer may make delivery on rated or unrated purchase orders for aluminum pigments and aluminum compositions subject to the provisions of Priorities Regulation No. 1.

Benzene, Toluene and Xylene Allotment Being Tightened The War Production Board announced on September 7, 1944 that civilian allotments of benzene, toluene and xylene will be drastically cut from now on through April 1, 1945 because of the increased military requirements for these chemicals. Smaller quantities of benzene will be available for use as lacquer thinners and in aniline dyes. All applications will be denied for benzene to be used in paint and varnish removers and brush cleaners. The cuts in allotment of toluene for lacquer thinners is also in the cards, as well as xylene for protecting coating.

Butyl Acetate Shortage During September no normal butyl acetate was available for non-military allocation because of the extreme shortage of this material. Military interim and emergency requests for the solvent were only handled on a firm order basis.

Ester Gum Prices Increased The Office of Price Administration issued Amendment No. 4 to Maximum Price Regulation No. 406, effective September 21, 1944 which permits price increases at all sales levels for ester gum containing gum resin which is used in paints. The amendment establishes a maximum price for ester gum with a resin content consisting wholly of gum resin at $0.1125 per pound delivered at the buyer's place of business. And the maximum price for ester gum with a resin content consisting of gum resin and wood resin is set at a price per pound equal to the weighed average of $0.1125 and $0.095, weighed according to the percentages of weight of gum resin and wood resin contained in the total resin content.

•

Linseed Crop in Argentine in 1944 The Argentine Ministry of Agriculture recently reported that Argentine's linseed crop in 1944 will yield 1,573,000 tons as compared with 1,348,000 tons in 1943. And according to official sources the purchases by the United Kingdom have been substantial in recent weeks.

Mexico Imports Metal Surface Paints It was learned from Department of Commerce sources that Mexico has 22 paint manufacturing concerns of substantial size. And since these plants supply most of the domestic needs the imports of paints consist principally of special purpose protective coatings such as lacquers to be applied to metal surfaces, varnishes for electrical equipment, and antifouling paints.

National Paint, Varnish & Lacquer Assn. Wins Honorable Mention Prize Secretary of Commerce Jesse H. Jones announced on September 1, 1944 the winners of the 1943-1944 national championships for cooperative services to business men by trade associations. The National Paint, Varnish & Lacquer Association was the winner of a special "Honorable Mention" Prize for its "vital part in the paint industry's development of scores of new types of protective coatings for every war-needed product which fights, floats, or flies. Also for overcoming manpower and material shortages, including the sponsoring of local war-problem clinics throughout the Nation to better acquaint producers, distributors, and the public with the industry's problems and procedures."

Phthalic Anhydride During October Because of difficulties which developed in the use of products conforming to specifications for lusterless finishes 3-173 Grade 2, semi-gloss 3-174 Grade 2, and gloss finishes 3-175A Grade 2, the Chemical Bureau of the WPB has authorized the use of either Grade 1 or Grade 2 enamels under these specifications during the months of September and October. Grade 1 enamels will be limited to a phthalic anhyride content of 31.5 per cent basis of total solids of paint. Previous to this ruling on August 28, 1944 there were no restrictions on this use of phthalic anhydride. Grade 2 of each of the specifications is limited by Direction 2 to Order M-139 to a maximum 16 per cent phthalic anhydride basis of vehicle solids in the paint.

Protective Coatings Under New Order Because of difficulty in securing satisfactory compliance of orders, according to the WPB, nineteen protective coating materials were consolidated under one order on September 6, 1944 known as Protective Coatings Conservation Order M-382. The coating subject to the new order are those which contain one or more of the following allocated raw materials: Acetone and diacetone as defined in M-352; benzene as defined in M-300-22; butyl alcohol and butyl acetates as defined in M-159; cadmium (cadmium pigments only) as defined in M-65; chrome pigments (Class B only) as defined in M-370; copper chemicals (cuprous oxide only) as defined in M-227; ethyl acetate and isopropyl acetate as defined in M-327; ethyl cellulose as defined in M-175; E. W. naphtha as defined in M-340; isopropyl alcohol as defined in M-300-12; methyl ethyl ketone as defined in M-169; methyl isobutyl ketone as defined in M-300-24; phenolic resins (protective coatings A only) as defined in M-246; phosphate plasticizers as defined in M-182; phthalate plasticizers as defined in M-203; phthalic alkyd resins as defined in M-139; toluene as defined in M-300-21; urea and melamine adlehyde resins as defined in M-300-34; vinyl polymers as defined in M-10; and xylene as defined in M-300-23. The new order provides that certificates will not be required for purchases from distributors of 275 gallons or less in any calendar month; but the distributors must assure themselves that deliveries are made in accordance with the end-use certificate they have given to the producers.

Protective Coating Oil Order Amended Amendment 1 to M-332 as issued on September 14, 1944 on oils for protective coatings states that "Section 3293.466 Conservation Order M-322 is amended in the following manner: In paragraph (b) the poundage figure appearing opposite 'Class #4' paints should be changed to read '3.5'".

Solvents Restrictions Amended Order M-150 was amended on September 11, 1944 to prohibit the use of Class A solvents for toys and games, jewelry, novelties and cigarette cases. And the amended order permits the use of Class B solvents for (1) zinc chromate primers for aluminum or magnesium surfaces for military services; (2) use in the production of Class B blends; and (3) for experimental and research work at the rate of one drum per month. The revised order also amended the definition of Class A solvents. These solvents are now described simply as those having an American Society for Testing Materials initial boiling point of 185° F. (85° C.) or higher to 50 per cent distillation point lower than 330° F. (165° C.).

Titanium Oxide to be Produced in Brazil The Department of Commerce has learned that Brazil plans to establish in the near future a titanium oxide industry because they have the natural resources for the production of this commodity.

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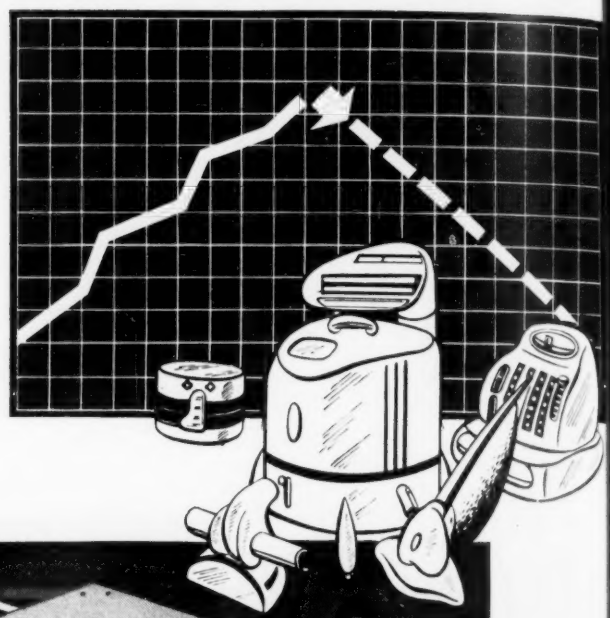
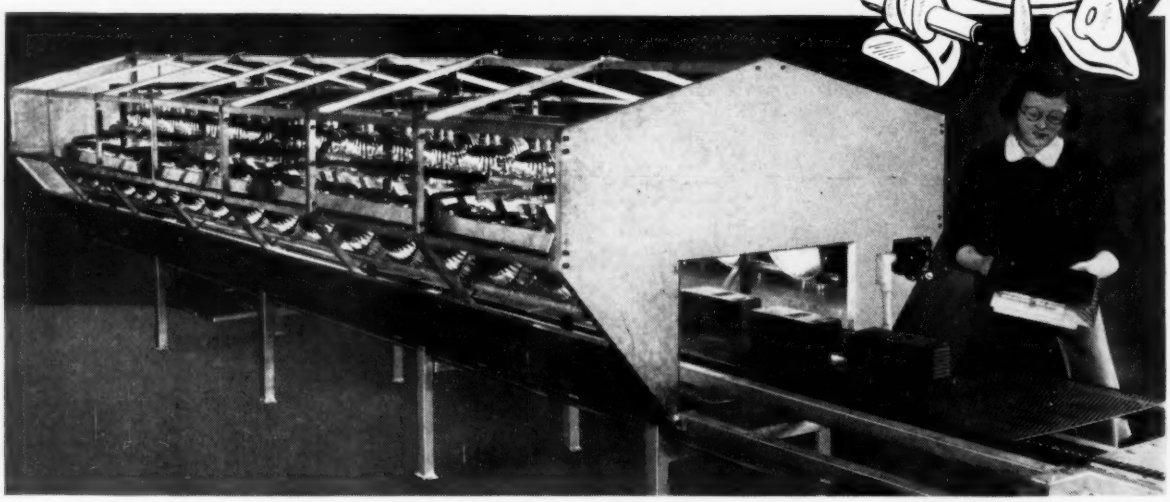


Faster production with a harder, tougher, finer finish will be important in many post-war operations when industry gets the "go" sign to resume production of consumer goods. Radio cabinets, cash registers, oil burner units, automobile parts, filing cabinets, air conditioning and cooling units, switch boxes, washing machines and other household appliances—are but a few of the products which, urgently needed, must be speeded to "hungry" markets.



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Plastic Finishing of Metal Products

By HAVILAND F. REVES
Detroit, Michigan

THE successful use of a plastic coating on metal parts at General Motors Truck and Coach Division indicates clearly the possibility of widespread use of similar plastic applications as a method of finishing. Economy in processing and a superior degree of protection are principal reasons for the favor with which the process is being received.

Previous discussion of this development has been primarily in terms of packaging. The elimination of sundry wrappings, cartons and boxes has become so important as these materials have become more and more critical that attention naturally centers on this use. However, the use of the plastic coat as a finishing process is likewise of great significance.

The plastic coating is intended, of course, as a temporary rather than a permanent covering. It is sufficiently durable to withstand the rigorous usage which parts receive from the armed forces in the field but it may be easily removed by manual stripping when the protected part is ready for use.

The use of this type of coating can eliminate the need for purely protective covering by paints, lacquers or similar finishes. If a part is "expendable", in the sense that it will be used up, as many military items necessarily are today, before it can suffer substantial damage from corrosion and similar causes, then it is unnecessary to give the part a preliminary finish. The plastic coating will furnish all the protection needed until the part is ready for action.

The development of this process started when the use of a stop-off lacquer was found unsatisfactory on a type of bearing shell. It proved to be too brittle and the present satisfactory formula and method using an ethylcellulose dip were worked out.

The plastic coating furnishes protection during handling, to the point where it is stripped off for ultimate consumption of the product, or to a point, such as retail display for consumer items, where protection is no longer necessary. Rough, polished, plated or painted surfaces can be protected in this manner. Some work also has been done on coating non-metal surfaces such as the porcelain of spark plugs. Practically any surface that can be dipped or otherwise coated is suitable for such protection. Research to date indicates that changes may be made in the formula of the coating to adapt it to special conditions.

A very important use of the plastic coating is for the temporary protection of parts prior to complete fabrication. This may be in the course of inter-plant shipments or in transit from subcontractors to assembly contractors, as well as on parts which may remain in plant storage because of seasonal or other factors. In such instances, the part in question may be completely machined and protected against both climatic conditions and accidents of handling and storage.

In the case of industrial use of the coating, maximum economy is possible. The coating, which is now a highly critical material, can be salvaged nearly 100 per cent and returned to the coating department for subsequent melting and reuse. If the parts being used are in a fair volume, a simple method of machine-stripping the coating could be introduced, reducing labor costs.

The present procedure uses a plastic which is translucent inasmuch as transparency is not needed. Further work on transparent coatings has been relatively successful and it is likely that this type will be preferred in much postwar processing.

The transparent coatings allow numbers or markings on the protected surface to be read through, thereby eliminating a need for external tagging. Easy identification of parts numbers, for instance, is thus made possible.

Specifications

The formula now used is required to meet a government specification of stability at 375° F. for 48 hours. This is intended to insure constant quality of the coating in the event, for example, that a batch of coating is left on the fire over a weekend shutdown. In normal use, however, such contingencies need not be anticipated and acceptable transparent formulas have been worked out which meet all essential requirements except this one.

The formula for the coating is approximately 25% ethylcellulose, 25% resin and plasticizer, and 50% mineral oil and wax. About 1% of stabilizer or inhibitor is sometimes added to maintain stability under heat.

The essential properties of the compound may best be summarized from the Ordnance specifications which it must meet.

Firepoint: at least 410° F.

Film thickness: not to exceed an average of .100" at 375° F. (with a tolerance of 3° F.)

Tensile strength: not less than 450 pounds per square inch

Elongation: not less than 50%

Stability: when heated at a temperature of 375° for 48 hours, test shall show:

a. No separation of individual phases or gelling.
b. Not more than 20% change in film thickness.
c. Tensile strength at least 350 pounds per square inch.
d. Elongation: no lower than 40%.

Brittleness: a test shall show no cracking or flaking, when exposed to a temperature of —40° F. (tolerance 3° F.) for 24 hours.

Exudation: not over 10% by weight on a film thickness of .050" to .100", when tested for 24 hours at 160° F.

The exudation test consists of the removal of both sides of a plastic coating from a flat panel and subjecting this coating to the specified temperature for 24 hours. The exuded moisture is then wiped off and the loss in weight of the coating is calculated.

One of the most significant properties of the coating is that it does not adhere to steel. While it is readily applied as a coating by the dipping technique to be described, it must meet rigid government tests for strippability. Experiment shows that it strips off clean, commonly in one piece, leaving no pieces upon the metal surface.

Evaporation is not appreciable since there are practically no volatile constituents. There is a very small loss of the plasticizer but this has no significance.

Another property of the coating of importance in practical application is its ability to bridge over small gaps. It will cover over a hole up to 3/16 inch in diameter or openings, such as those on spark plugs, up to ½ inch.

Most involved of the required tests is a cycle of exposures to humidity, cold, heat and salt water immersion. This covers the extremes of climatic conditions encountered by the armed forces. It also insures that the formula will meet any climatic conditions that postwar commerce will encounter, with the possible exception of temperatures below —40° F. This extreme range is likely to be of significance only in the case of stratosphere air cargo routes where protective heating for occupants of the plane would be required anyway.

The climatic cycle test, given for ten days, is as follows:

1. 16 hours at 100° F. in 100% relative humidity.
2. 3 hours at —40° F.
3. 2 hours at 160° F.
4. 3 hours immersion in 5% sodium chloride solution at room temperature.

This gives the equivalent of 25 years of normal exposure to climatic conditions.

Application

The coating is shipped in blocks and sawed into pieces about 2" x 3" x 9" for ease of melting. These are placed in a melting pot and heated to about 350° to 375° F.

Experience has shown the desirability of two separate containers for the plastic — one a melting pot, commonly called the "mother",

and the second a dipping pot. The mother pot is kept at uniform temperature during operations and receives all fresh stock.

The possibility of a single mother pot serving an entire installation of dipping pots of various sizes and shapes is obvious. The present installation is an experimental wartime development without the time for all the refinements that will be added when this process, now established, becomes a part of peacetime production. At present, therefore, there is a separate mother pot for each dipping pot. Both are approximately 15 gallon size. Postwar or newly engineered wartime installations would probably include a central mother pot discharging into the battery of dipping pots by means of an insulated piping system. Or, the mother pot would be made mobile so that it could be moved by truck, monorail or other means to each dipping pot as needed.

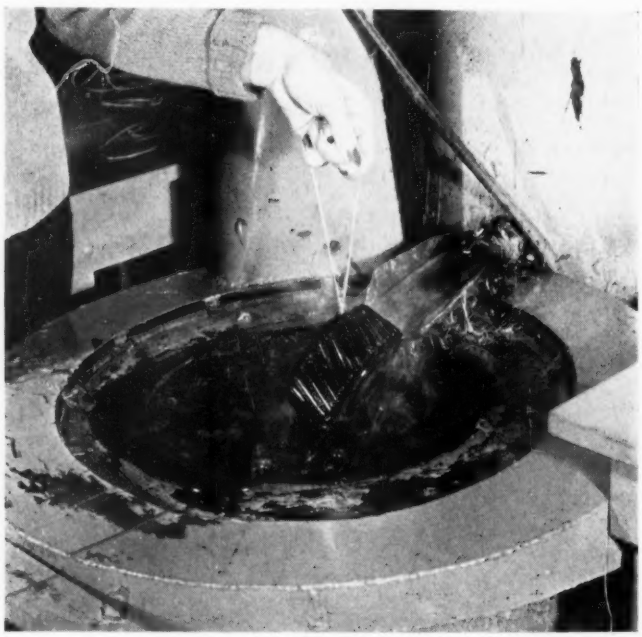
Present heating is by electric strip heaters. It has been suggested that an oil jacket should be installed around the pot so that heating would have maximum uniformity.

Another suggestion has been made for agitation in the pots, particularly the mother pot, to keep the liquid plastic in motion. It has been suggested that the low heat conductivity of the plastic may cause it to stratify but experience so far indicates that there is little difficulty from this source. If it developed, for instance, with some other plastic formula used for some special purpose, the installation of an agitator would probably overcome this difficulty.

The mother pot in the installation is placed above the dipping pot and discharges into it by means of a hand-controlled valve. The discharge spout is heated to maintain the temperature of the plastic as it passes into the dipping pot. Frequent addition of fresh stock to the mother pot allows the maintenance of a consistent volume of melted plastic during operations. In use the stock is consumed at such a rate that the entire stock is replenished every three or four hours.

The part to be coated is dipped into the plastic in the dipping pot for approximately two seconds, pulled out, allowed to drip back into the pot and then dipped into cold water which causes the coating to harden in about five seconds. Dipping is now performed by hand. A piece of string is tied to each part which is suspended by the operator from the string. (The protuding string ends serve as a convenient means of cutting the coating when it is ready to be stripped off.) Depending on the part, the operator can hold one or more pieces at a time. Some odd-shaped pieces, such as shafts, may require double dipping or other technique to cover all surfaces.

Hand operation presents very little hazard to the operator, despite the temperature of the solution. Gloves, which were tried for a time, proved awkward to the operators. It was found that there was practically no splash as the part was dipped into the liquid and this protection was not required.



Hand dipping a small gear in plastic.

Stripping the plastic coating.

An interesting technique of smoothing out occasional bubbles in the coating, which can be detected by visual inspection, is the use of a soldering iron. The coating quickly responds to the heat.

Special methods for dipping lie in the immediate future of postwar production. Development of a conveyor dip is the logical probability, each part being dipped for the required length of time and then cooled by air as it travels to the next operation. Conveyors are now used in part for the removal of coated parts but the variety of parts being turned out for war production makes further use of the system difficult at this time. The air-cooling, incidentally, would eliminate the water dip now used to speed cooling.

The economy of the coating operation is one of its greatest advantages. This is based upon the speed of dipping and cooling, as compared with normal hand operations. The facility with which it may be accomplished is dramatically indicated by the present average of 325,000 parts coated per day. It should be emphasized that these are of some 3,000 different sizes and shapes.

Labor saving over hand wrapping has been as high as 90 to 95 percent. One report was that one operator could perform the operations formerly requiring 40 operators with hand wrapping methods. An individual operator is now able to dip up to 28 small pieces a minute using the simple technique of suspending two pieces by their strings from each hand. Conveyor dipping would naturally result in greater savings.

The use of a corrosion preventive is eliminated by this process and both application and removal of such a preventive when the product is ready for use (after stripping) are made unnecessary. The coating contains from 40 to 50 per cent mineral oil and wax and furnishes sufficient corrosion preventive. Earlier use of the coating included a preliminary oil dip for additional protection but this proved unnecessary and has been eliminated. A further degree of protection is furnished by a slight degree of internal exudation upon the surface of the metal.

Parts treated with this plastic dip have withstood the climatic cycle tests for 3,000 hours, compared to failures at 1,000 to 1,500 hours for parts treated under the formerly acceptable method — wrapping in plain paper, outer wrapping in no-oxid cloth (grade C type 1) and double dipping in wax to seal — a laborious, expensive process.

Ruggedness of the coating in service has been well tested. Loose boxes of coated parts have been carried in a truck for days over rough roads and have been placed on the vibrating machine, subjecting them to the extreme shocks that would be encountered in shipping and handling, and the coating has stood up satisfactorily.

This last test points to the possible use of bulk shipment of coated parts.

One further advantage of the coating is that certain types of parts, such as bearing assemblies, can be packed with the grease required in operation and then given an over-all coating, with the grease packed right in.

There is one important caution that should be observed in con-

nection with the plastic coating: occluded air should be kept at a minimum unless suitable corrosion preventive is applied to the unprotected surface. The design of the product, of course, determines whether or not the liquid plastic will cover the entire surface. Some assemblies might permit the development of air pockets under the coating. Some gears have been given a preliminary corrosion-preventive dip for this reason.

Many special developments are possible with plastic coating. One of the mail order houses has been experimenting with a transparent coating for a line of tools. Another interesting development is a carton pack of bolts, immersed side by side in the plastic. Each bolt may be cut off the pack as it is dispensed and the rest will remain thoroughly protected in the flat, convenient pack.

An outstanding possibility lies in the field of export trade where varying climatic conditions must be met. The experience gained during the war will be put to good advantage in the development of types of plastic coatings suitable for various products and uses in postwar commerce and industry.

Centrifugal Finishing

By JOHN E. HYLER

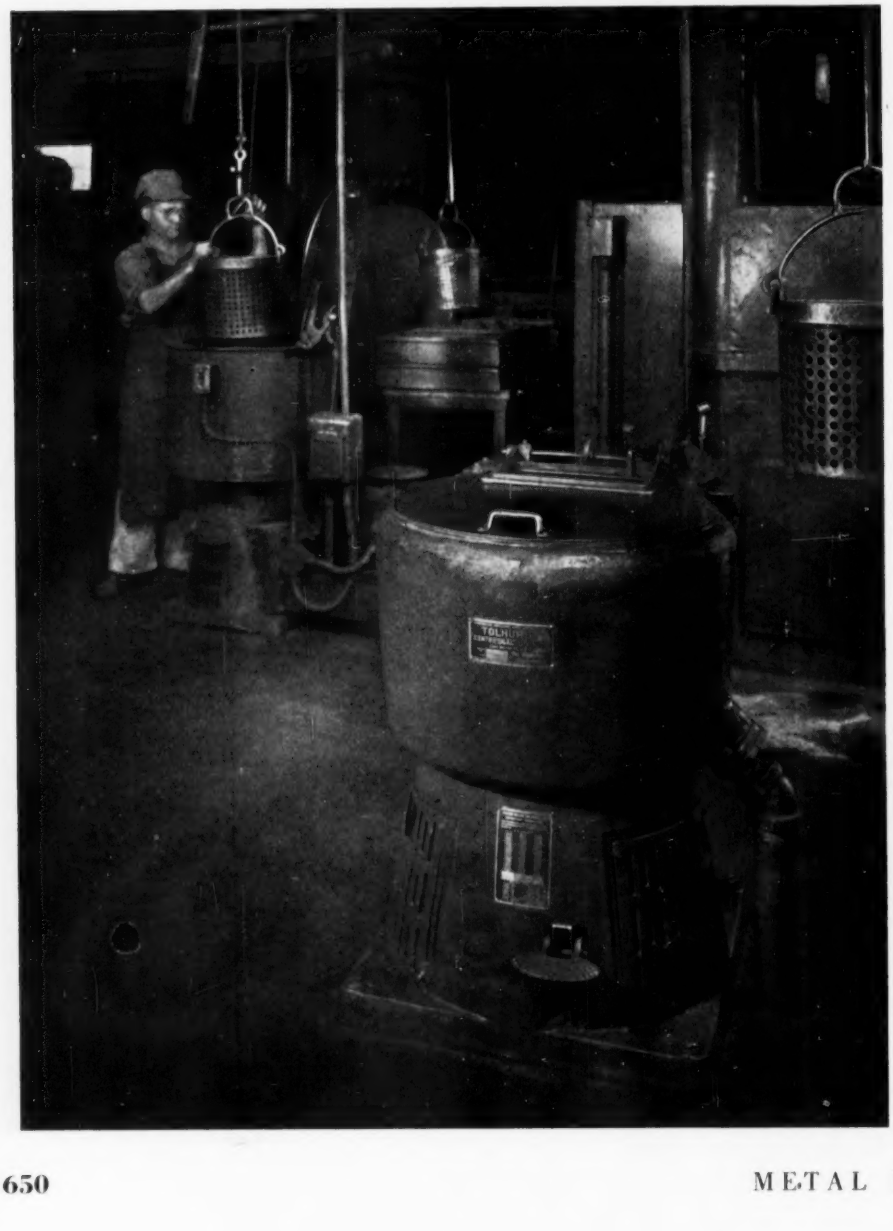
Peoria, Illinois

THERE are a number of aspects of the subject of centrifugal finishing, since there are many different operations which might in a very real sense be regarded as finishing operations. There is, for instance, a special washing, rinsing and drying unit that is especially designed to handle screw machine parts and to perform all of these operations on them centrifugally. Some screw machine parts receive no coating. Some, however, are galvanized and some coated with finishing materials. The manufacturer furnishing the combined centrifugal washing, rinsing and drying machine also produces a centrifugal galvanizer, a centrifugal enameler and other centrifugal dryers which can be used in combination with other types of washing and rinsing machines.

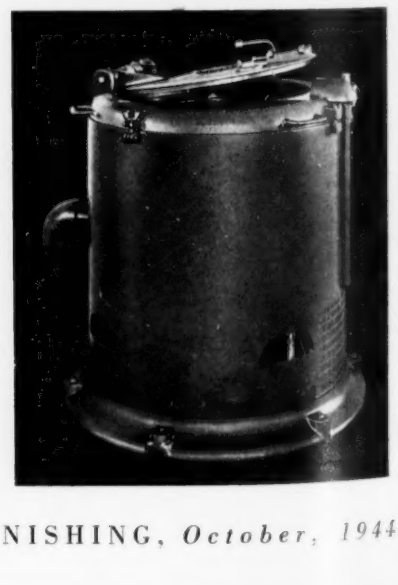
In many cases, centrifugal machines are served by monorail, for this provides a method by which both fatigue and bother are greatly reduced. Shown in Fig. 1 is a dryer where this method is used. The ease with which the operator handles the buckets may be seen. Centrifugal galvanizers are especially worthwhile and offer a decided improvement over the old method of shaking or tumbling small parts after galvanizing to remove the surplus zinc. Especially in the case of threaded parts, the advantage is appreciable. The parts are placed in a perforated basket and carried through the zinc bath in the regular way. The basket with its contents is then placed in the centrifugal machine and quickly revolved. The centrifugal force drives all excess metal from the parts. Even the threads come out sharp and clean with a finish of high quality and luster. The zinc slingings are recovered and may be returned to the kettle. The work is done very quickly —a characteristic of centrifugal operation—and in consequence the production rate is high.

Centrifugal Enamelers

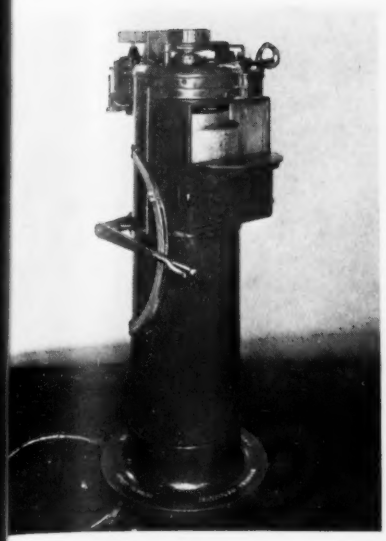
The centrifugal enameler, like centrifugal galvanizers, is not designed or recommended for the coating of flat parts or very large parts. It is best used for coating small parts in quantity. Centrifugal enamelers are available in different sizes ranging in capacity from one cubic foot to more than 15 cubic feet. Due to the necessity for balancing the large loads with great care, the large machines are different in design. The case carrying the revolving basket on larger machines is suspended on a plane running through the mid-depth of the basket. This arrangement leaves the revolving mass free to find



(Left) Fig. 1. Centrifugal dryer served by monorail.



(Below) Fig. 2. Centrifugal machine for japanning and enameling.



(Above) Fig. 3. Centrifugal enameler. The basket containing the parts to be coated is dipped into the finishing material in the bottom of the machine by lever action, then raised and whirled.

(Right) Fig. 4. Large centrifugal enameler, working on same principle as machine shown in Fig. 3. Basket filled with parts is being inserted for dipping and whirling. Mechanical door of sliding type closes automatically when charge is inserted.

its own center of gyration, with the result that very smooth running balance is obtained. Provision is made in these machines for readily changing the color of the enamel or the lacquer being used without loss of time and without any danger of contaminating the next product to be finished.

In Fig. 2 is shown a centrifugal enameler which has found wide application. It is not fair to say that centrifugal machines will properly coat all kinds of articles but there are many that can be handled to advantage. Toys of various kinds, small castings, helical springs, hairpins and other wire goods, hooks and eyes, small fastenings, chains and similar items are typical examples. This particular machine has a quick-stopping feature that is very interesting. The rotation of the basket in which the work is placed is controlled by a conveniently located lever. The arrangement is such that moving the lever to the right accelerates the bowl clockwise. Moving the same lever to the left will decelerate the bowl smoothly and to an immediate stop. If the lever is held to the left, it will start the basket spinning in the opposite direction.

A safety interlocking arrangement has been provided at the top of this machine which makes it impossible to spin the basket unless and until the top lid has first been closed. If desired, and this is required by some state laws, an additional safety provision may be included in the form of a fixture which prevents opening the cover until the machine has completely stopped.

Machines like the one shown in Fig. 2 may be obtained in different sizes and may be provided with a wide variety of removable wire-mesh baskets for holding the work. The design of the basket used for a given type of work often has much to do with the results obtained. It may be said that for all products which lend themselves to enameling in a centrifugal machine there is no other method by means of which a more thorough or a more even coating can be obtained and no way in which so little of the finishing material is wasted since all of the excess material that is thrown off is salvaged.

Most of the manufacturers now produce finishing materials that have been especially developed for use with centrifugal machines. Not only is it good practice to obtain finishing materials that have been developed to lend themselves for use with centrifugal machines but it is also important to have an operator for the machine to keep the material at the proper consistency to provide a uniform coating. When this is done, the thickness of the coating applied may be very closely controlled. Enough enamel is flowed over the parts to submerge them

completely and, by timing the spinning interval of the machine, control of the thickness is obtained.

The enamel thrown off in the spinning operation is in some cases simply caught in a bucket placed under the drain. The operator lifts the bucket and pours the material back over the next batch of parts being coated. However, where it is desired, a pumping and tank unit is furnished with the machine. In such cases, the tank is used to recover the enamel which is returned to the bowl of the machine each time by means of the pump. This is much more convenient, especially where the machine is being used continuously.

As in the case of the centrifugal galvanizer mentioned above the centrifugal enameler will evenly coat threads on bolts, nuts and screw machine parts of different kinds without leaving any filled threading. Hollow objects may be coated, since the coating material is forced into every opening under the action of centrifugal force. In some cases, where the material is whirled long enough to leave a very thin coating, the pieces are sufficiently dry when taken from the machine to be dumped into containers and handled. In other instances, it is necessary to empty the parts into shallow trays and allow them to air dry for 20 to 30 minutes, after which they can be loosened, transferred to other trays and baked.

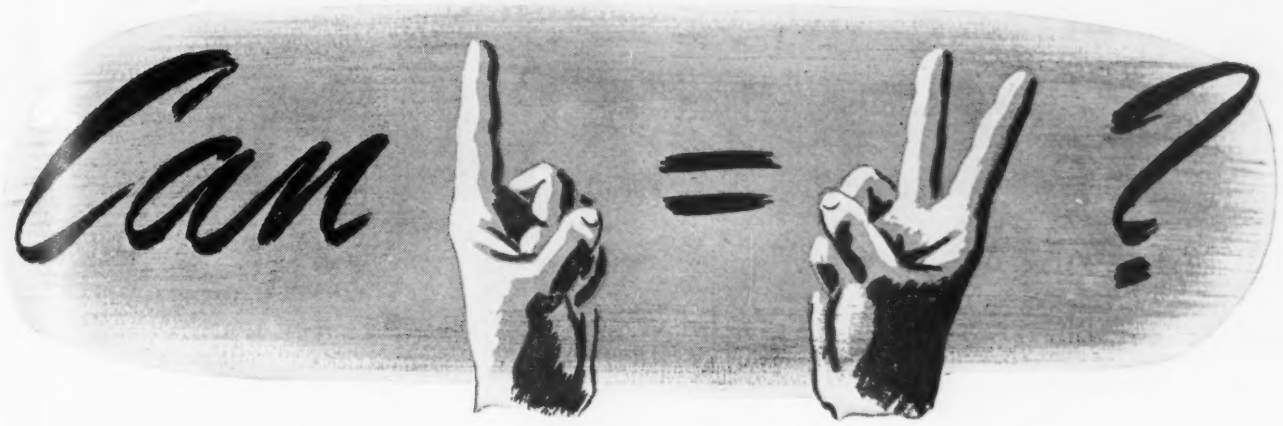
In general, the centrifugal enameler is supposed to be a substitute for the dipping method, but there is one very interesting centrifugal machine which combines dipping and whirling operations. This is a machine with a solid base and a tank for the finishing material located directly in the base so that the basket can be dipped into the material, then raised and set to whirling for throwing off the excess material which returns to the reservoir in the base of the unit.

Such machines are built in a variety of sizes ranging from 312 cubic inches to 1206 cubic inches. A view of the small machine with the door open in front may be seen in Fig. 3. There is a mechanical sliding type door which closes automatically. By means of the hand lever on the left hand side of the machine the basket is lowered until submerged and then raised to the whirling position. Twenty to 25 complete operations can be performed per hour on a machine of this kind. The machine is started and stopped by means of a single lever.

Fig. 4 shows a view of a large dipping-whirling machine in process of being loaded. The basket shown is of cast aluminum, lined with steel mesh wire. It is 10 inches in diameter. This machine is fitted with hydraulic controls for raising and lowering the work basket, thus eliminating worker fatigue.

It is difficult to say how fast the centrifugal finishing process will forge forward in the years ahead but we are sure that it will continue to gain ground. Since designers of various products give consideration to so many different points, it would not be at all surprising to see various small parts on many products re-designed to make them more adaptable for centrifugal finishing in order to more fully reap the benefits of this method.

(Illustrations courtesy of Tolhurst Centrifugal Div. of American Machine and Metals, Leon J. Barrett Co., and Ronci Machine Co.)



Yes...
DEOXIDINE
Cleans and Conditions Metal Surfaces In One Operation

DEOXIDINE removes rust, eliminates or inhibits rust producers—removes light annealing scale, oxides or oil and *leaves the surface properly conditioned to receive a durable paint finish.*

Mathematically one can never equal two, but chemically the DEOXIDINE process does the work of two, combining in one operation both cleaning and conditioning to receive paint finish.

DEOXIDINE is the original phosphoric acid type cleaner and cleans not only the surface, but eradicates the rust and rusters from the pits in the surface, thus insuring the utmost in protection for lasting paint finish.

There are types of DEOXIDINE suitable for use in brush, spray or immersion processes and that may be adapted to removal of varying amounts of grease or rust met with in finishing metal products.

PEROLINE like DEOXIDINE has a two-in-one action. Applied to unpainted surfaces of cold rolled or machined steel, it effectively prevents rusting.

Constituents of PEROLINE react at the same time with the metal to destroy rusters, remove blushes of rust, and create a surface admirably suited for painting when the oil phase left by PEROLINE is removed.

Proved in peacetime and war, DEOXIDINE and PEROLINE have helped speed the production of the more durable material required by our armed forces and our allies. In planning for your postwar fabrication and equipment, we offer the experience of ACP Technicians and the facilities of its well equipped laboratories. They are at industry's call for the solution of metal treating problems.

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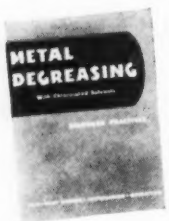
C-10

CHEMICALS ACP PROCESSES

WHY

VAPOR DEGREASING*?

Modern vapor degreasing methods utilize the chemical and physical properties of Trichlorethylene or Perchlorethylene and specially designed equipment to save time and cost in the rapid, efficient removal of grease from metal parts. Vapor degreasing has helped speed up war production. In postwar production, it will prove invaluable as a *basic* aid to faster, more economical production of better peacetime products.



"METAL DEGREASING—STANDARD PRACTICE"

This new book, prepared by Du Pont in consultation with equipment manufacturers, outlines the fundamentals of safe and efficient operation of vapor degreasing machines. Copies on request.

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..THROUGH CHEMISTRY

THIS METHOD...

1. **Thoroughly removes grease** and oil from metal parts of any size or shape, usually in a minute or so.
2. **Produces parts clean,** warm and dry —ready for inspection, assembly, further fabrication or finishing of any type.
3. **Minimizes finishing rejects** because vapor reaches and removes grease and oil from deep draws, holes and places which are almost inaccessible.
4. **Reduces risk** of damage to delicate parts.
5. **Can be used alone** or as a part of a process flow line.
6. **Utilizes** compact equipment that fits into small space.
7. **Consumes** only small quantities of solvent. Contaminated solvent is recovered economically for re-use.
8. **Uses** the absolutely pure vapors of a non-flammable solvent as a cleaning medium.
9. **Simplifies** cleaning procedure, is easy to operate as a process.
10. **Saves time and cost**—in its own operation, and in the subsequent handling and finishing of parts.

E. I. DU PONT DE NEMOURS & CO. (INC.)
Electrochemicals Department
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***Vapor degreasing is basic for good metal cleaning. For each job there is a suitable cycle or combination of treatments. In every case, the final rinse in pure, uncontaminated solvent vapor assures positive removal of the last traces of grease and oil.**

Amyl Acetate

Problem

What are the hazards and what precautions should be observed in the use of amyl acetate?

Hazards

The hazards are those of fire, of explosion, and of poisoning by contact with the liquid or by inhalation of the vapors.

Discussion

Amyl acetate (banana oil) is a colorless, volatile, flammable liquid with an odor resembling that of bananas. Its vapor is heavier than air and diffuses rapidly. Air containing 1.1 per cent by volume of the vapor is an explosive mixture. The flash point of chemically pure amyl acetate varies from 77 to 80 degrees Fahrenheit. The flash point of the commercial grades varies from 70 to 91 degrees Fahrenheit. Amyl acetate is only slightly soluble in water but dissolves readily in alcohol, ether and chloroform. It is used as a solvent in the manufacture of photographic films, pyroxylin lacquer, patent leather, bronzing liquids, metallic paints, art glass, perfumes, incandescent electric lamps, dry batteries, and imitation fruit flavors. It is obtained by distillation from a mixture of amyl alcohol, acetic acid and sulphuric acid, or by adding a mixture of amyl alcohol with sulphuric acid to gray acetate of lime and distilling by steam heat. Amyl acetate is usually shipped in iron drums or tin cans. The Bureau of Explosives regulations classify it as a flammable liquid and require the filled containers when shipped to bear a red label.

Symptoms

Continued contact with amyl acetate dissolves the fat in the skin and causes the skin to become so dry and irritated that mild dermatitis may follow. Continued inhalation of the vapors causes nervousness, pains in the head, giddiness, nausea, drowsiness, cough and irritation of the respiratory system. The vapor also irritates the membranes of the eyes. The vapor of chemically pure amyl acetate will not cause chronic poisoning or other serious after effects, but the vapor of the commercial grades may do so because of the presence of impurities.

Precautions

Persons who have inhaled the vapor of amyl acetate should be removed to an uncontaminated location where there is plenty of fresh air. The effects due to inhalation will usually disappear at the end of two or three hours.

Persons exposed to contact with liquid amyl acetate should coat the skin with a lanolin base cold cream as a protection against the solvent action of the liquid.

Work rooms in which amyl acetate

is used should be thoroughly ventilated and, if it is possible, an exhaust system should be installed to remove the fumes at their point of origin.

Workers exposed to the vapors should wear non-ventilated goggles to protect the eyes and a canister gas mask with a canister filled with an absorbent for organic vapors to protect the respiratory organs.

No smoking or open flames should be permitted in rooms where amyl acetate is stored or used. Signs calling attention to such prohibitions should be conspicuously posted in those rooms and at the entrances.

Artificial lighting of work rooms and other places where amyl acetate is used or stored should be by means of incandescent electric lamps enclosed in vapor-tight globes.

Non-ferrous tools should be used to open amyl acetate containers.

Amyl acetate should be handled and stored in accordance with the requirements of "Regulations of the National Board of Fire Underwriters for the Installation of Containers for Storing and Handling Flammable Liquids" as recommended by the National Fire Protection Association, or "Flammable Liquids — Industrial Storage and Use" by the Associated Factory Mutuals Fire Insurance Companies.

(From Industrial Data Sheet D-Chem. 4, issued by the National Safety Council, Inc., Chicago, Ill. Reprinted by permission.)

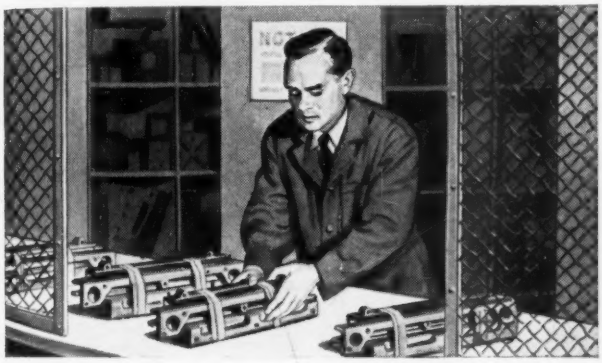
"PERHAPS I'D BETTER HAVE IT WRAPPED!"

Do you know...?

Quiz on timely production short-cuts—No. 7

Q. What are these men opening?
☐ Blood plasma ☐ Anti-seasickness pills ☐ De-salting kit

A. De-salting kit—now standard equipment in life boats and life rafts. To seal the canister in which this kit is packed and to seal the tablet package inside, Permacel moisture-proof cloth tape (Utilitape) is used. About a foot of this tape is also included in the kit to mend possible rips in the precious rubber "bottle."

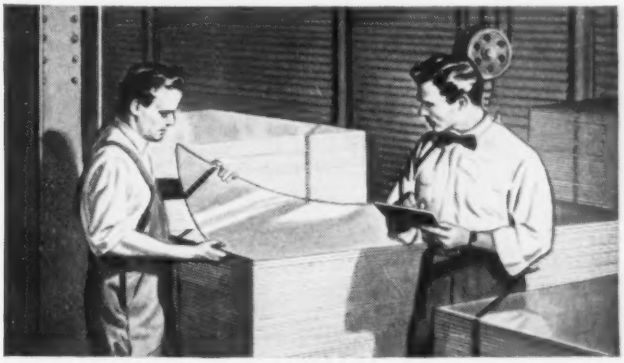


Q. This modern plant speeds production by:
☐ Tagging individual parts ☐ Keeping parts in separate bins
☐ Bundling complete unit assemblies

A. Bundling complete unit assemblies. All parts needed for an assembly are gathered in the stock room and bundled together with Permacel cloth tape (Jonflex). Inventorying is simplified. Assembly is speeded up. No parts are lost, no time wasted searching through bins.

Q. First post-war bathtubs will probably be made of:
☐ Cast iron ☐ Plywood ☐ Plastics

A. Cast iron. To protect the porcelain surfaces of bathtubs during installation, a special Permacel tape is used to hold a "liner" in place while plastering is under way. Holds tight till the job is finished, then strips off clean, leaving smooth, white, unmarred surfaces.



Q. How many different grades of steel go into making a car?
☐ 17 ☐ 70 ☐ 170

A. 70. To identify different grades of steel and other materials, Permacel's companion, Texcel cellophane tape, is used by many manufacturers. Made in many colors, this tape also speeds work and cuts costs during installation of fuel lines and ignition systems. Texcel sticks at a touch, hangs on tight, strips off clean.

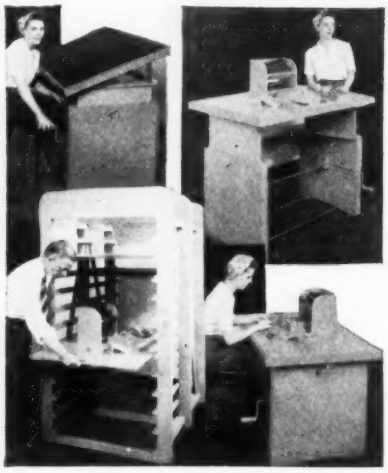
Q. The tape on this jeweler's window is part of the:
☐ Insulation ☐ Decorative scheme ☐ Burglar alarm system

A. Burglar alarm system. A special Permacel metal tape (Metacel) is used for this purpose. Also used to seal fuse chambers in hand grenades, this tape will find many other interesting uses after the war—in decoration, as an indoor aerial under your rug and wherever a combination conductor-and-sealer is needed.

NEW EQUIPMENT AND SUPPLIES

Drying and Baking

A survey conducted recently by The Fostoria Pressed Steel Corp. revealed that industrial plants have a great need for portable radiant energy equipment to facilitate baking, drying and preheating operations.



The extreme flexibility of model P-7-IR, designed for such service, permits it to be used in singular or multiple assemblies. Adjustable features of the cross arm on the upright and the reflector yoke allows the radiant energy to be directed at various angles from a height of 18" to 6 feet.

Research disclosed that this model is advantageous for drying out electrical equipment, drying off material after degreasing, baking insulation on electric motor parts, baking finish on a variety of products, preheating material to facilitate assembly, preheating thermoplastics to facilitate shearing, punching, molding, experimental purposes in laboratories, dehydration operations, etc.

Descriptive material is available from The Fostoria Pressed Steel Corp., Dept. OF, Fostoria, Ohio.

Preparation of Copper Alloys for Finishing

The preparation of copper, brass and bronze for painting, lacquering and enameling has heretofore been unsuitable and it has been difficult getting good adhesion of organic finishes on these alloys.

It has been found that the Ebonol "C" process of the Enthone Company, Dept. OF, Elm Street, New Haven, Conn. will produce a stable, adherent, non-reactive cupric oxide coating on copper alloys that gives high adhesion of lacquers, paints and enamels under severe weathering conditions. The inert nature of the Ebonol "C" coating prevents reaction between it and the organic finish. The catalytic nature of copper itself has been one of the causes for breakdown of the bond of organic coatings to copper alloys.

The finish obtained is nap-like in nature and presents a relatively absorbent base for the paint. The process is suitable for treating copper alloys containing from 60-100% copper. The lower copper alloys are colored a mahogany brown and alloys containing more than 65% copper are colored black. The Ebonol "C" finish, therefore, is not suitable as a base for clear lacquers or for one coating of white pigmented lacquer due to its dark color.

The finish is applied by simple immersion of the work in a dilute solution of the salts operated near 210°F. The treating time is approximately 10 minutes.

Solvent-Proof Hose

A flexible solvent proof hose known as "compar" is now being used by Pan American World Airways System in the newly adopted process of hot doping fabric covered surfaces of B-314 flying boats. This vinyl resin derivative, developed by Resistoflex Corporation, Dept. OF, Belleville, N. J., which is well known for its use in handling aviation "super-fuels" has now proved itself to be impervious to organic solvents even at high temperatures. Two lines, each 50 ft. in length, carry the hot solution from a small heating unit on the floor of the hangar to all parts of the Clipper. The second line is used to return unused dope to be reheated to 175°F.

The compar hose is satisfactorily meeting the very exacting requirements of a conduit that is entirely inert to hot solvents and that will not cause deterioration of the dope. In addition, the wear resistant qualities of compar leave the hose undamaged when dragged over the floor, pulled up to high control surfaces, stepped on, or even run over by trucks.

Through the use of this solvent proof hose Pan American is now saving as much as 34 hr. per 1000 sq. ft. of surface treated, with a decrease of 84 lb. per plane.

Automatic Finishing System

The Industrial Oven Engineering Co., Dept. OF, 11621 Detroit Ave., Cleveland, has developed a new automatic finishing system for painting the steel landing mat sections used in building emergency airfields, and this machine is said to be immediately adaptable, without construction change, for a variety of peacetime work.

The system has set completely new speed records in the finishing of landing mats, with speeds ranging from 400 to 600 sections (20″x10′-0″) per hour degreased, dip-painted, baked, cooled and unloaded ready for shipping. The machine consists basically of a continuous cross-bar conveyer, which carries the parts through the various processes; a vapor degreaser; an agitated dip tank, and a three-zone oven, which dries, bakes and cools the mats continuously.

Automatic operation, including the use of mechanical loaders and unloaders, cuts manpower requirements to a minimum; in some cases, four men have been enabled to do the work previously done by 20. Only casual supervision of the system's operation is required.

Reject rates have been cut materially by this equipment, never exceeding ¼ of 1 percent of total production. Further economy is realized in reduced fuel costs. A heavily insulated oven shell, maximum recirculation of oven atmosphere, and use of pre-heated air from the cooling zone as make-up air for the heating system result in fuel savings of from 12 to 25 percent, by actual test.

Further information may be obtained by writing to the company.

Patents

Coating Composition

U. S. Pat. 2-353,910. W. P. Lawler, G. J. Hable and J. V. Steinle, assignors to S. C. Johnson & Son, Inc., July 18, 1944. A coating composition comprising a resin resulting from the polymerization of a vinyl ether of an alcohol having from about 10 to 35 carbon atoms, an alkyd resin which has been modified about from 25% to 90% with an oxidizable unsaturated fatty acid and a volatile organic solvent for the modified alkyd resin, the ingredients being present in the proportion by weight of about from .1 of one to 13 parts of the said polyvinyl resin to 100 parts of the said modified alkyd resin, whereby, upon evaporation of the solvent, a flexible, moistureproof, homogeneous, strong, tough and firmly adherent coating or film is produced.

Paint Proportioning

U. S. Pat. 2,354,259. N. Grubelic, July 25, 1944. In a machine for proportioning the standard color paint ingredients of a desired mixed paint, a vertically movable indicator, a lever controlling the height of the indicator, a pivot for the lever and adjustable therealong, the indicator being arranged on one side of the pivot, and means for progressively moving that part of the lever on the other side of the pivot for selected distances and thereby raising the indicator different but correspondingly proportionate distances.

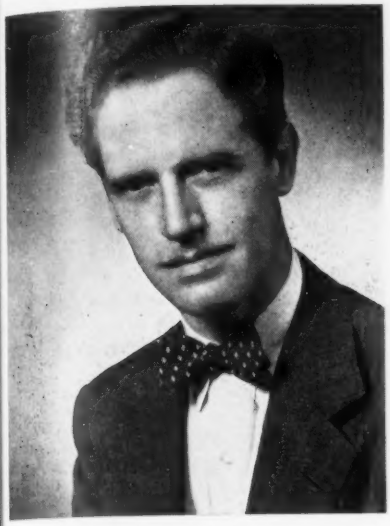
Paintbrush Cleaner

U. S. Pat. 2,354,898. C. J. Wiksten, Aug. 1, 1944. A brush cleaning machine of the character described comprising a frame, an oblique cylinder having peripheral teeth and mounted for axial rotation in said frame, means carried by said frame to engage the opposite oblique end surfaces of said cylinder whereby the cylinder is reciprocated as it is rotated, and a brush support mounted for oscillatory movement in said frame whereby the bristles of the brush mounted on said support may be manually moved to and from the path of travel of said cylinder teeth.

Spraying Process

U. S. Pat. 2-355,225. W. MacWilliam, assignor to Resistoflex Corp., Aug. 8, 1944. The method of forming a homogeneous deposit free from occluded air bubbles from a water-miscible solution of polyvinyl alcohol of such viscosity that if sprayed by means of compressed air even at elevated temperatures it will form a frothy deposit, which comprises atomizing said solution by means of steam under pressure to form a spray, and depositing said spray on a surface.

Business Items



Brendan Sullivan

The appointment of *Brendan Sullivan* as advertising supervisor has been announced by *E. L. Feininger*, division manager of the resin and insulation materials division of the *General Electric Co.*, Schenectady, N. Y.

Until recently Mr. Sullivan had his headquarters in Bridgeport, Conn., where he worked on the promotion of resin and insulation materials, tungar and metallic rectifiers and, for a short while, fluorescent accessories. He has been with the company for two years.

Before joining G-E in September, 1942, he had worked three years for Lee-Stockman, Inc., advertising agency, and three years with F. W. Dodge, Inc., publishers.

J. F. Kurfees, Jr., president of the J. F. Kurfees Paint Company, Louisville, Ky., has joined the *Defense Supplies Corporation*, a unit of the Reconstruction Finance Corporation, it has been announced. Mr. Kurfees will organize and direct a section of the Defense Supplies Corporation to dispose of surplus paints, varnishes, lacquer and allied materials which are in the hands of government agencies.

According to data released by the Bureau of Census on sales of 680 reporting companies, the total sales of paint, varnish, lacquer and fillers for the first six months of this year were $310,008,821. Total sales for the corresponding period last year were $280,472,015.

Announcement has been made of the election of *S. W. Fletcher* to the presidency of the *J. O. Ross Engineering Corporation*, New York, N. Y. Mr. Fletcher, for many years vice-president of the company, will continue to make his office in New York.

Philip T. Sharples has been elected a director of *U. S. Industrial Chemicals, Inc.*, it was announced by *C. E. Adams*, chairman of the board of the company. Mr. Sharples is president and a director of the Sharples Corporation and Sharples Chemicals, Inc.

Hubert Glatte of Buffalo, former assistant purchasing agent for the National Gypsum Company, has been appointed district engineer for the *Industrial Oven Engineering*

Hubert Glatte

Company of Cleveland and will cover the Western New York territory for this firm.

Mr. Glatte has previously been employed in various engineering capacities by the Turner Construction Company, the Associated Buffalo Architects and the Buffalo Board of Education. In 1937 he went to National Gypsum where he remained until he accepted his present position with Industrial Oven.

It has been announced that *Interchemical Corporation*, New York, N. Y., has acquired *Murphy Varnish Company* and *Scriver & Quinn, Inc.* to augment operations of its Ault & Wiborg Division.

Murphy Varnish Company, which dates its experience back to the first industrial finishes manufacturer in this country, William Tilden & Newphew, has had its main plant in Newark, N. J. for more than three quarters of a century. It also has a plant in Chicago and a branch in San Francisco.

The present management and personnel, headed by *Charles J. Roh* as president and *Paul S. Kennedy* as vice-president, will continue intact but the name will be changed to the more broadly descriptive one of *Murphy Finishes Corporation*.

BONDED

with Chicago FV

the Pedigreed Bond

It's the new bond that gives the ultra smooth finishes you get with Chicago Grinding Wheels—

Precision finishes undreamed of before—

Finishes so accurate that you can measure them in micro inches with a Surface Analyzer.

PERFECT FINISH INSURANCE

Whatever you have to finish—metals, alloys, plastics, wood, laminates or composition materials—you can do it better with Chicago Wheels.

Chicago Wheels have kept pace with the precision requirements of our war industries, and you can use them with confidence to finish civilian goods better in double quick time.

CHICAGO GRINDING WHEELS

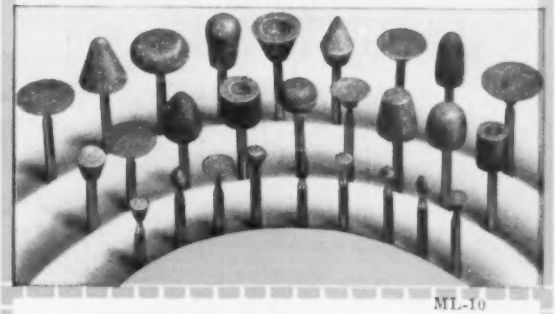
A wide range of grains and grades and—for the duration—sizes up to 3" in diameter.

CHICAGO MOUNTED WHEELS

The first made and the finest today. In a selection of bonds, abrasives and shapes to handle each job more efficiently.

TRY ONE FREE

We'll send without charge a Mounted Wheel or an FV Bond Grinding Wheel. Tell us size you'd like.



Write for Catalog listing all Chicago products and showing comparative photographs of finishes with different kinds of Wheels.

CHICAGO WHEEL & MFG. CO.

Headquarters for Mounted Wheels and Small Grinding Wheels

1101 W. Monroe St., Dept. ML, Chicago 7, Ill.

MOUNTED WHEELS SMALL GRINDING WHEELS

*Half a Century of Specialization has established our Reputation as the Small Wheel People of the Abrasive Industry.

ML-10

Send Catalog. Interested in

☐ Mounted Wheels. ☐ Grinding Wheels.

☐ Send Test Wheel. Size.....

Name.....

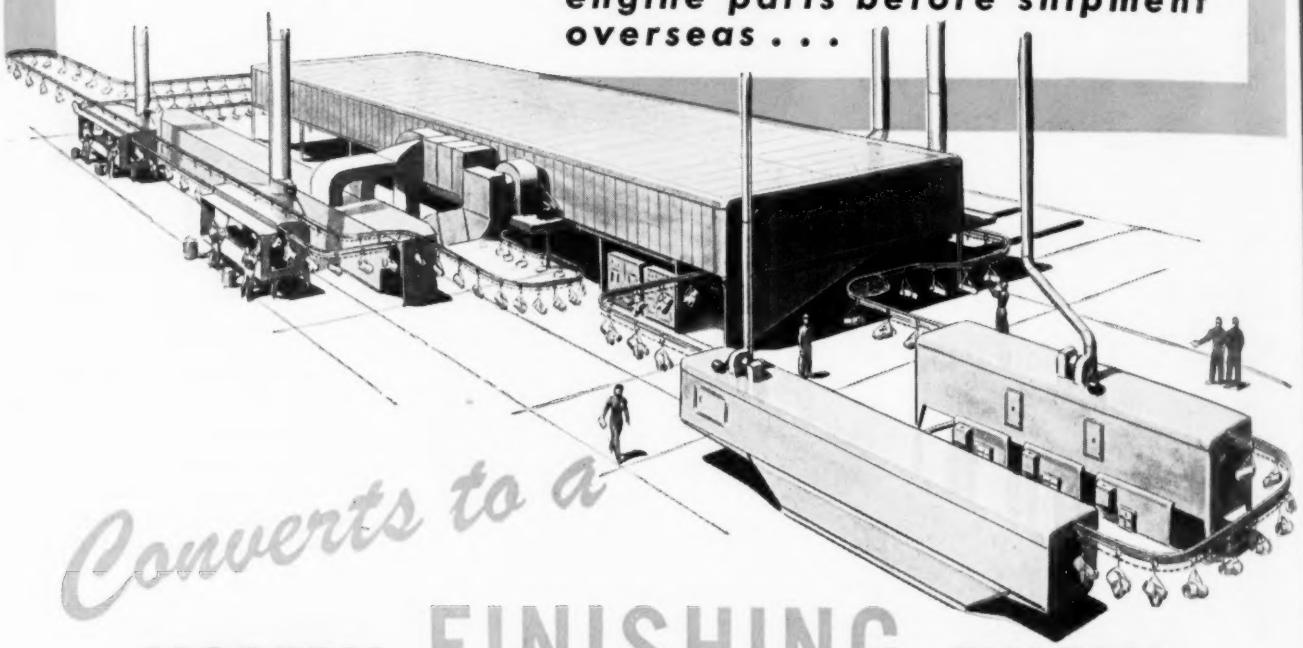
Address.....

MAHON

Built-for-the-Job

CLEANING AND COATING SYSTEM

specially developed for treating engine parts before shipment overseas . . .



Converts to a

MODERN FINISHING SYSTEM

for the Coming Peacetime Operation

Many Finishing and Processing Systems—engineered by Mahon for special war production purposes—now are being revised for peacetime operation—often with only slight change and at surprisingly little expense.

The Mahon engineering staff is cooperating with numerous manufacturers on transition problems. In preparing plans for adapting present equipment to the demands of rapidly approaching civilian production they are accomplishing some highly satisfactory results. Have a Mahon representative go over your equipment with you. You will find the advice and suggestions he is prepared to offer both practical and sound. Your switchover will be made speedily and smoothly—and at a minimum cost. You will have a production line that incorporates the most recent advances in efficient and economical Finishing equipment—insuring a faster, finer output.

THE R. C. MAHON COMPANY

DETROIT 11 — CHICAGO 4

Manufacturers of Metal Cleaning Machines • Rust Proofing Machines • Hydro-Filter Spray Booths • Ovens of All Types • Filtered Air Supply Units • Hydro-Foam Dust Collectors—and Many Other Units of Special Production Equipment—including Complete Finishing Systems

REBUILT POLISHING LATHES

IMMEDIATE DELIVERY

3 HP Westinghouse, 230 volt DC, 2000 RPM. on cast iron pedestal, double shaft extension, 10". Complete witth retaining rings.

$150.00
FOB CLEVELAND

REBUILT PLATING GENERATORS

1000 amp. 6 volt Bogue with AC Motor Drive.
600/300 amp. 6/12 volt, Hobart with 220 volt 1 phase motor drive.
400/200 amp. 7½-15 volt Hobart—vertical with 110/220 volt single phase 60 cycle motor drive.
250 amp. 7½ volt General Electric.
200 amp. 7½ volt Hobart with 220 volt 3 phase 60 cycle motor drive.
150/75 amp. 7½-15 volt Eager.
150 amp. 7½ volt Roth with 220 volt single phase 60 cycle motor drive.
90 amp. 8 volt Continental.

THE MOTOR REPAIR & MFG. CO.
1555 Hamilton Ave. Cleveland 14, Ohio

FOR SALE
(AVAILABLE FOR IMMEDIATE SHIPMENT)

1 **4000/2000 AMPERE, 6/12 VOLT, HANSON & VAN WINKLE COMPANY "INTERPOLE DESIGN"** Motor Generator Set. Separately Excited. Complete Control Equipment.
1—**3000/1500 AMPERE, 5/16 VOLT, CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set (practically new). **"INTERPOLE" DESIGN.** Separately Excited by Motor Generator Set. Complete Control Equipment.
1—**3000/1500 AMPERE, 5/10 VOLT, CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set. Separately Excited. Full Control Equipment.
1—**2500/1250 AMPERE, 5/10 VOLT, CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set. Separately Excited. Complete Control Equipment. Excellent Condition.
1—**1500/750 AMPERE, 6/12 VOLT, CONNECTICUT DYNAMO & TRIC CO.** Motor Generator Set. Separately Excited. Complete ment. Excellent Condition.
1—**1500 AMPERE, 6 VOLT, HANSON & VAN WINKLE CO. "INTERPOLE CONSTRUCTION"** Motor Generator Set. Double Commutator Design. (Can be operated at 1500 Amperes, 12 volts). Separately Excited. Full Control Equipment.
1—**1500/750 AMPERE, 6/12 VOLT, CONNECTICUT DYNAMO & MOTOR CO.** Motor Generator Set. Excellent Condition.
1 **1500/750 AMPERE, 6/12 VOLT, HANSON & VAN WINKLE CO.** Motor Generator Set. Self-excited. Full Control Equipment.
1—**1000 AMPERE, 12 VOLT, EAGER ELECTRIC CO.** Motor Generator Set. Single Commutator Design. Separately Excited. Full Control Equipment.
1—**1000 AMPERE, 8 VOLT, CHARLES J. BOGUE ELECTRIC CO.** Motor Generator Set. Single Commutator Design. Separately Excited. Excellent Condition.
1—**750 AMPERE, 6 VOLT, HANSON & VAN WINKLE CO.** Motor Generator Set. **"INTERPOLE CONSTRUCTION".** Double Commutator Design. (Can be operated at 375 amperes, 12 volts). Full Control Equipment. Excellent Condition.
1—**500 AMPERE, 24 VOLT, HANSON & VAN WINKLE CO.** Motor Generator Set. **"INTERPOLE DESIGN".** For Anodizing. Excellent Condition.
2—**ABBOTT BALL COMPANY**—30" x 8" Triple-compartment Burnishing Barrels, complete with linings, gaskets, etc. Belt-driven.
1 **COMPLETE ANODIZING UNIT**—including **CHANDEYSSON ELECTRIC COMPANY 1000 AMPERE, 40 VOLT,** Motor Generator Set, with Synchronous Motor with controls; Tanks with temperature recorders, controllers, etc. **BRAND NEW.** Write for details.

MANY OTHER SIZES IN STOCK

BAIRD & ABBOTT—Burnishing and Tumbling Barrels. Polishing Lathes, Rheostats, Ammeters, Blowers, Tanks, Polishing Wheels and many other items for the Plating and Polishing Department.

WRITE FOR DETAILS

M. E. BAKER COMPANY
143 SIDNEY ST. CAMBRIDGE, MASS.

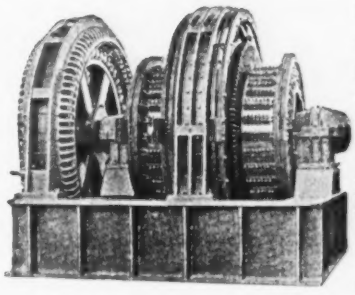
REBUILT AND GUARANTEED
POLISHING AND PLATING EQUIPMENT
Plating Dynamos and Motor Generator Sets

All Sizes Carried in Stock
Tumbling and Plating Barrels and most anything for the Plating Shop
Largest Stock of Rebuilt Polishing and Plating Equipment in America

Let us have your requirements. Entire plants or parts thereof bought for cash. Send us list with prices.

J. HOLLAND & SONS, INC.
274 South 9th Street, at Broadway, Brooklyn, N. Y.
EVergreen 7-3314—3315—3316

REBUILT AND GUARANTEED
Polishing and Plating Equipment



Largest and most complete stock of plating generator sets in America, too numerous to list, 100 amperes, to 7500 amperes, 6/12 volts. Rheostats, Tumbling, Burnishing and Mechanical Plating Barrels.

Polishing & Buffing Lathes—Belt Drive, Motor Drive and Multi "V" Belt Drive.

Blowers, all sizes, belt and motor driven.

We carry a complete line of plating and polishing equipment and supplies.

Whatever your requirements may be in the plating and polishing line—call us for prices before placing your order.

WRITE — PHONE — WIRE

CLINTON SUPPLY CO.
112 So. Clinton Street Chicago, Illinois
Phone, Franklin 3538-3539

FOR SALE

CAnal 6-3956-7

1—750 Ampere 6 Volt Motor Generator Set complete with control panel.

1—600 Ampere 6 Volt Motor Generator Set.

BEAM-KNODEL COMPANY
195 Lafayette St., N. Y. City

BUSINESS WANTS For Sale—Equipment, Etc.

Display Advertisements, One Column Wide, $6 per inch, Each Insertion

PESCO PRODUCTS

1—6000 AMP., **CHANDEYSSON** generator.
1—3200 AMP., **EDDY** motor generator set.
3—4000 AMP., **CHANDEYSSON** generators.
1—6000/2500 AMP., 8/16 VOLT, **BOGUE** generator.
1—2500/1250 AMP., 6/12 VOLT, **CONNECTICUT** Motor Generator Set.
2—1500/750 AMP., 6/12 VOLT, **OPTIMUS** Motor Generator Sets.
1—1500/750 AMP., 6/12 VOLT, **EDDY** Motor Generator Set.
1—1000 AMP., 8 VOLT, **BOGUE** Motor Generator Set.
1—1000/500 AMP., 6/12 VOLT, **EDDY** Motor Generator Set.
1—400/200 AMP., 7½/15 VOLT, **CHANDEYSSON** Motor Generator Set.
40—**GARDNER NO. 3, BALL BEARING** Polishing Machines.
20—**GARDNER NO. 3,** 5 H.P., and 3 H.P. motor driven polishing and grinding machines—ball bearing.
1—**UDYMATIC,** 14 station, 3 Head Automatic polishing machine.
8—**BAIRD No. 1 and 2,** oblique, motor driven burnishing barrels.

The most complete line of Scratch brushes, buffs, felt wheels, emery wheels, buffing compounds, plating supplies, polishing supplies. All sizes and shapes.
Plastic finishing equipment and supplies a specialty.
PeKay-Synthetic rubber wheels for fine emerying and deburring. Cheapest, because they last longer. Sizes from 1"x½" to 12"x3".

DISTRIBUTOR AND STOCKING JOBBER OF:

Nuglu and Brushing Nuglu
Kellog Spray Equipment—from a nozzle to a complete spraying plant
U. S. Electrical Tools and Equipment
General Electric—Rectifiers, motors and equipment
Worthington compressor units and pumps, featuring Worthite chemical pumps
Industrial Filters and corrosion testing Equipment
Sterling motors—Gear reduced-Speed trol
Kocour—Testing Units—Bristol Controls
Boice-Crane Equipment for Plastics
Buffalo Blowers and Drill Presses

MANUFACTURERS OF PESCO EQUIPMENT

Plating Barrels, Rheostats, Polishing machines, Utility Blower Systems, Burring machines on benches with Dust Removal System. Complete suppliers of anything for the plating or polishing rooms for metal or plastics.

PLATING EQUIPMENT & SUPPLY CO.
182 GRAND ST., NEW YORK, N. Y. CA. 6-5249

Immediate Shipment

CHANDEYSSON

Synchronous Motor Drive

Latest Type—Two Years Old

Guaranteed

1—1000 ampere 60 volt Direct Current 60 kw Chandeysson Synchronous Motor Generator Set. 450 R.P.M. 3 ph. 60 cycle 220 or 440 volts, with direct connected exciter and A.C. Automatic Starter and D.C. Panel Board. Temperature Rating 25° C. rise.

1—1000 ampere 6 volt Double Commutator Chandeysson Synchronous Motor Driven Plater. 600 R.P.M. 3 ph. 60 cycle 220 or 440 volts. Complete with Push Button Starter and D.C. Panel Board.

New York City's largest stock of Electrical Machinery

L. J. LAND and COMPANY

Established 1910

152 GRAND STREET NEW YORK 13, N. Y.

BRANCHES { Reading, Pa. (10th & Exeter Sts.) / York, Pa. (323 East Market St.)

We are actively in the market to purchase your surplus or idle electrical machinery.

FOR RESULTS ADVERTISE IN METAL FINISHING

SITUATIONS OPEN

PLATING FOREMAN

SITUATION OPEN—Foreman for old established Hard-Chromium Plating Plant. Must be thoroughly experienced on all types of machine tools, salvage work, etc. Permanent position for right man. If you aren't one of the best Hard-Chromium platers in the Country, don't apply. Give age, experience and salary desired. Address Box April 2, care Metal Finishing, 11 West 42nd Street, New York 18, N. Y.

METALLURGIST AND CHEMIST

SITUATION OPEN—A key position in a nationally known company is about to be filled. Company now producing related war products and is pursuing a comprehensive postwar development program. Man selected for this position must be thoroughly trained and experienced in metallurgy and chemistry. He should possess theoretical knowledge required for conceiving and developing new processes and products. Submit full personal training and experience record and salary expected. Employment will be in accordance with WMC regulations. Address replies to: October 4, care Metal Finishing, 11 West 42nd Street, New York 18, N. Y.

POLISHING & BUFFING EQUIPMENT SALES MANAGER

SITUATION OPEN—Well established midwest machinery builders want manager capable of assuming full responsibility for success of line of Automatic Polishing and Buffing Machinery. Must be familiar with all branches of finishing and preferably have engineering ability. Outline experience last ten years and give age. Confidential. Address replies to: October 1, care Metal Finishing, 11 West 42nd Street, New York 18, New York.

BUSINESS WANTS For Sale—Equipment, Etc.

Display Advertisements, One Column Wide, $6 per inch, Each Insertion

SITUATIONS OPEN

INDUSTRIAL FINISHES SALESMAN

SITUATION OPEN—WANTED—for New York and surrounding territory. Wanted by an old established Eastern manufacturer of lacquers, enamels, synthetics. Submit full qualifications and information when replying. Address replies to: October 2, care Metal Finishing, 11 West 42nd Street, New York 18, New York.

PLATING EXPERT

SITUATION OPEN—Gold and silver plating expert. Must have many years experience in fine jewelry finishing. High rate of pay and assured future. Plant in New York City. Address reply to: Sept. 1, care Metal Finishing, 11 West 42nd Street, New York 18, N. Y.

OPPORTUNITY FOR YOUR VACATIONS. EXPENSES PAID PLUS BONUS

SITUATION OPEN—For man who has had experience in the manufacture of aluminum—kitchen ware. Will send details by request. Please send references to: Productos Ceramicos, P. O. Box 486, Monterrey, Mexico.

BUFFING AND POLISHING COMPOUND CHEMIST

SITUATION OPEN—Experienced Chemist in Research and Manufacturing Buffing and Polishing compounds. Connection open with large Eastern Company. Will consider part time man. Address replies to: Buffing Compositions, care Metal Finishing, 11 W. 42nd Street, New York 18, N. Y.

SITUATIONS WANTED

TOP FLIGHT ELECTROPLATING ENGINEER

SITUATION WANTED—Graduate chemical engineer with more than 10 years in every phase of electroplating, research, development and production, completing important war research Nov. 1, desires permanent connection with large Company or Institution. Specialized fields have been: design and development, automatic plating, wire, ribbon, novelties; precious metals, nickel. Patents, many published papers. Available on short notice if necessary. Address replies to: Automatic, care Metal Finishing, 11 West 42nd Street, New York 18, New York.

FOREMAN PLATER

SITUATION WANTED—Foreman Plater, 20 years experience. Able to make and maintain all standard solutions with analytical report. Wishes position with reliable concern. Address replies to: S. Ferenz, 1188 Fox Street, Bronx, New York.

METAL FINISHING

SITUATION WANTED — Metal Finishing man with 19 years experience, covers polishing, buffing, deburring, painting, lacquering, specification and decorative plating, heat treating, formulation and electrochemistry laboratory control, installation layout, supervision. Address replies to: October 3, care Metal Finishing, 11 West 42nd Steet, New York 18, New York.

METAL FINISHING CHEMIST

SITUATION WANTED—Extensive supervisory experience operation and control practically all types plating operations on most metals in still tank, semi-automatic, full automatic and barrel. Experienced metal treating processes such as anodizing, rustproofing etc. Experienced electroforming materials from photoengraved plates such as electrolytic wire mesh, reticles etc. Address reply to M. F. C., care Metal Finishing, 11 West 42nd St., New York 18, N. Y.

« « INDEX TO ADVERTISERS » »

ODDS and ENDS

Alphabetics:

A complimentary copy of the 1944 *Guidebook* will be mailed to the first reader (*George B. Hogaboom* excepted) who recognizes the following and its source:

The Letter "E"

Some one has advanced the opinion that the letter "e" is the most unfortunate character in the English alphabet because it is always out of CASH and forever in DEBT; never out of DANGER and in HELL all the time. But we call attention to the fact that the "e" is never in WAR and always in PEACE. It is the beginning of EXISTENCE, the commencement of EASE and the end of TROUBLE. It is the center of HONESTY and makes LOVE perfect. It starts EFFICIENCY. It is the starting of END and the ending of CARE.

The Printed Page:

Glancing over an article on plating practice, which recently appeared in another publication, we again came across the phrase "*emersed* in the solution" and again we repeat that *emerse* means to *take out*, not to *put in*. The same author states that zinc or cadmium plated work must be subjected to a final rinse of *clear, running* water containing sufficient *chromic acid* to maintain a pH value less than 6.8. Who said there was a shortage of chromic acid??

According to *Aluminum News-Letter*, a thickness of 0.005" is the dividing line between foil and sheet. In other words, everything thicker than 0.005" is sheet and everything thinner is foil. Now will someone please tell us what a strip *exactly* 0.005" thick should be called!

The anode bag of the future may be made of rubber. Porous sheets containing as many as 6,400 perforations per square inch are being produced and have already given good service as anode bags for heavy silver plating.

A bow to DuPont for using the word *non-flammable* in their ad. *Non-inflammable* always makes us burn, despite Webster's insistence that *flammable* is obsolete!

Hard to Believe:

We are informed that the ocean is not all salty. Over wide stretches of sea, off the coast of Labrador, the water is not salt but fresh. Icebergs melt as they drift southward and the water that runs from them, being fresh, is lighter than salt water and therefore rests on the surface of the ocean. All we know is that we never swallowed that kind of ocean water, and we've swallowed plenty in our time.

Among the many causes of absenteeism offered, the best one of the lot comes to us via a jewelry magazine, in which an editorial suggests that it may be due to *blood pressure!*

Things We Never Knew:

Adsorption of as little as 0.0005% by weight of hydrogen is enough to cause hydrogen embrittlement of steel.

One cubic inch of activated carbon has an active surface area of 132,000 square feet—an area larger than two football fields.

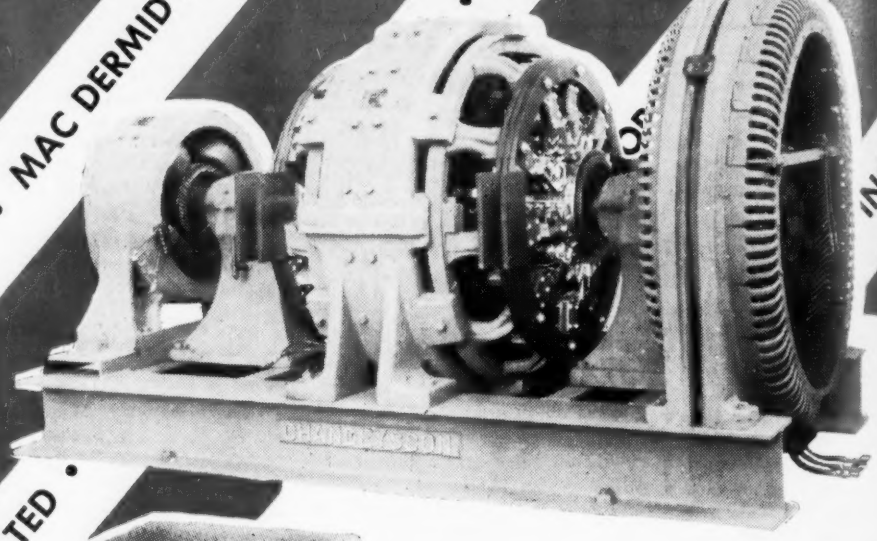
We always thought that the *filar micrometer* was so called because it was invented by a man named *Filar*. The dictionary informs us that the instrument is called by that name because of the crosshair employed, the word *filar* being derived from the Latin *filum* meaning thread. Oh, well! It's been a long time since we studied Latin!

The Whole Truth:

A New York department store advertises its novelty jewelry as "*gold flashed.*" The next step will be to employ the more appropriate term by which such jewelry is known to the trade and advertise it as "*junk jewelry.*"

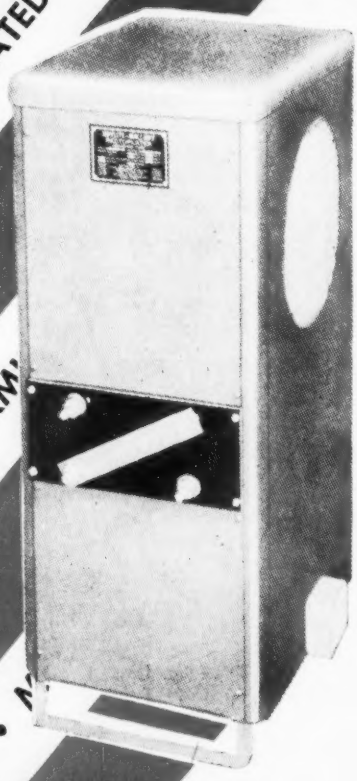
Question of the Month:

What shall we call it: *Chromatizing, Chromadizing, Chromodizing* or *Chromating?* Let's all get together, boys!!



GENERATOR

Chandeysson low voltage motor generator sets for any plating or anodizing operation in capacities of 100 to 20,000 amperes up to 50 volts—25° C. or 40° C. rise. Modern, sturdy, efficient, low speed. All units, generator, exciter and synchronous or induction motor manufactured by Chandeysson.



RECTOPLATER

A recently introduced, Udylite-Mallory standardized rectoplater for delivery of a definite ampere out-put, on straight-line production methods, that is sized to come nearest to meeting the requirements of all kinds of plating, anodizing or other finishing operations. Will deliver either 1440 amps. at 6 volts or 720 amps. at 12 volts. Available for 440 volts or 20 volts, 3 phase, 60 cycle. With UDYLITE plating barrel, plating time may be reduced by 20 to 30% through elimination of voltage loss.

Junior, 6 Volt, Rectoplater

The unit has thirty steps of voltage regulation up to 400 amperes maximum. There is full protection against current overloads. Equipped with ammeter and voltmeter. Makes separately controlled amperes available for individual racks or bays for any plating operation. Available for three phase, 60 cycle, 220 or 440 A.C. current . . . $341.00 F.O.B. Detroit.

WRITE FOR SPECIFICATIONS AND PRICE

CONSIDER YOUR *Equipment* NEEDS NOW!

Consult Your MAC DERMID INC. Service Engineer About the New, Improved Metal Finishing Equipment

HEADQUARTERS FOR NEW ENGLAND

MAC DERMID INCORPORATED, manufacturers of compounds for cleaning for over twenty years, represent many of the country's leading equipment manufacturers and are the exclusive distributors in New England for the **UDYLITE CORP.**

Don't wait until X-Day to determine the metal cleaning, plating and finishing equipment you will need for post-war production. Your MAC DERMID INC. representative has been trained in all phases of metal finishing problems and is equipped to help you determine the ideal equipment for every problem. Ask him to show you folders on the equipment illustrated and place your orders as early as possible for future deliveries.

Anodes and Anode Bags • Tampico, Steel and all types of Bristle Brushes • Pumice • Buffing Compositions • Buffs • Felt Wheels • Dipping Baskets • Rubber Aprons and Gloves • Test Sets • Degreasing Solvents • Soap Chips • Other materials necessary for the plating and finishing industry.

WRITE FOR FOLDERS